Personal Computer

Owner's Manual

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BEFORE YOU BEGIN

Before you begin using this book, you must read this part in the first place.

The PC/XT is power general purpose single board computer. It is designed to be 100% compatible with IBM PC/XT and with additional enhancement. It can be selected to runtwice as fast as an standard IBM PC/XT (TURBO mode-8MHz) or at the same speed as the IBM PC/XT (NORMAL speed mode-4.77MHz) by simply flipping a switch.

If the installation of internal options on your system board was different from chapter 4 "system board instruction", Please see chapter 10, and 11. In this chapter, we will supply same Kind about the installation of internal options by designed differential system, It will do you good!

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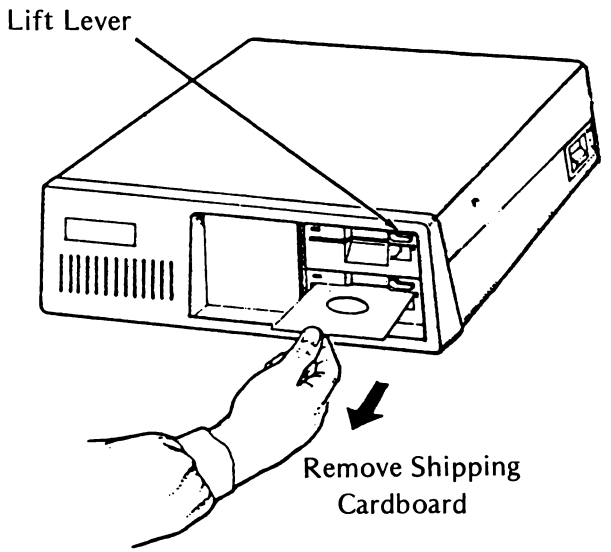
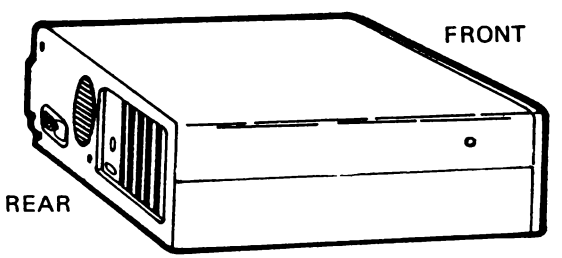
CHAPTER 1 SET UP YOUR PC/XT

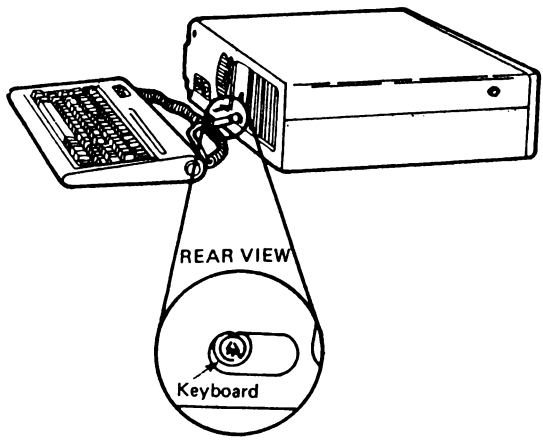
1. If your 16 BIT PC/XT personal computer came with a diskette drive installed, remove the shipping card board from the drive (s).



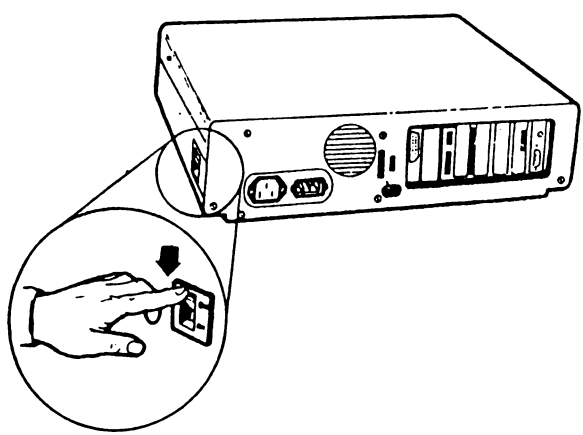
2. Place the Processing Unit on a proper level area.



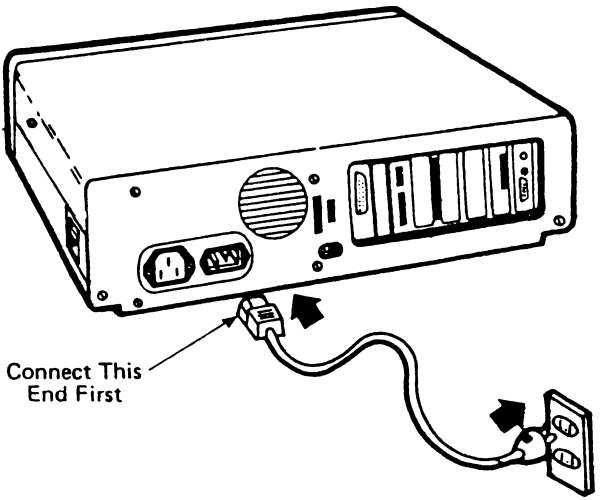
3. Place your keyboard in front of the Processing Unit and connect the coiled cable, to the rear of the cabinet, as shown in Figure. The unit will not initialize without the keyboard cable properly plugged.



4. Flip the power switch to off position, located in the left rear of the unit.



5. Plug first the power cord to the Processing Unit, then to a wall outlet.

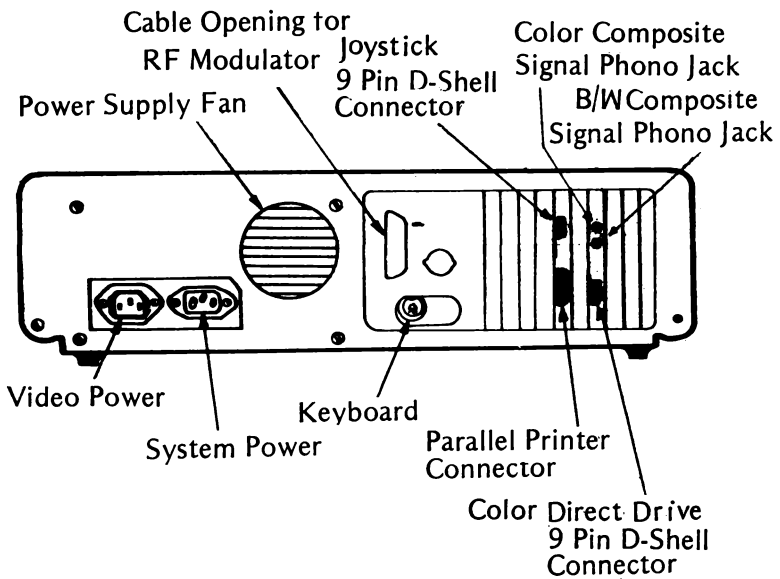


6. Flip the power switch to the ON position, you could hear one short beep. This short tone indicates that your PC/XT has completed its selftest.

7. Rear Panel Reference

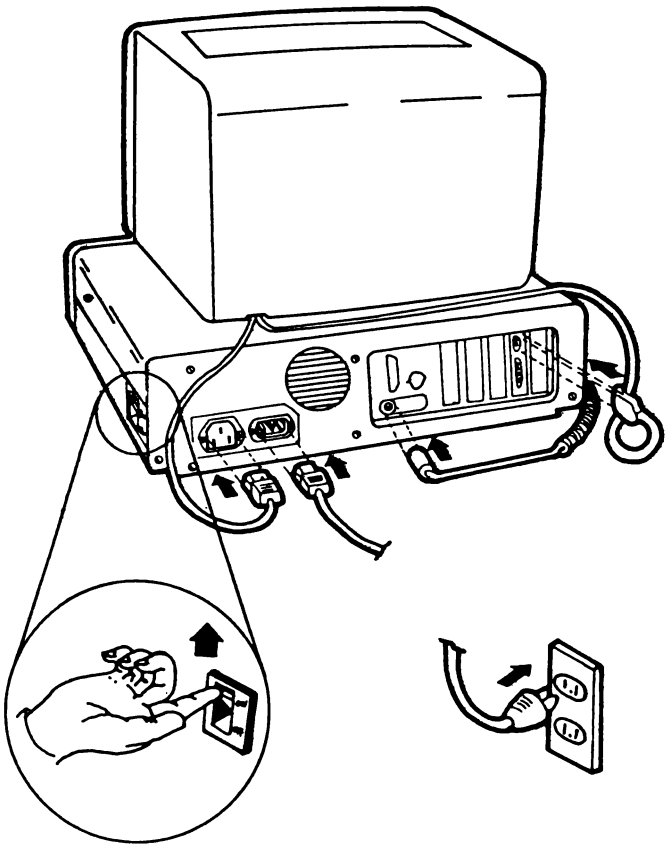
This figure illustrates the rear panel of the PC/XT. please follow this illustration carefully when installing and connecting all your cables and cards.

REAR PANEL



8. System Test

A. Place the monitor on top of the Processing Unit and plug the monitor cable to the rear of the unit, as shown in Figure. Then connect the monitor power cord to the monitor and then to the switched Ac socket illustrated above a wall outlet.



B. Turn the video controls of your monitor completely clockwise.

C. When the PC/XT is powered on, it performs a selftest that takes between 3 to 30 seconds, depending on how much memory the system has.

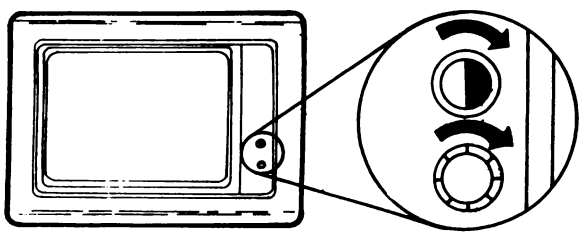
Flip the power switch to the ON position. These occurrences should be noted:

1. The cursor will appear on the monitor screen.
2. A short tone will sound after the memory test.

These responses will indicate, if the PC/XT has self-tested successfully. If other information is present on the screen, please call your PC/XT dealer.

In case the information displayed on the screen is shifted to the left of the screen, please refer to the "MODE" command explanation in your DOS manual.

D. Now adjust the brightness and contrast controls of the monitor for greater visual comfort.



Your PC/XT personal computer is now ready for your command.

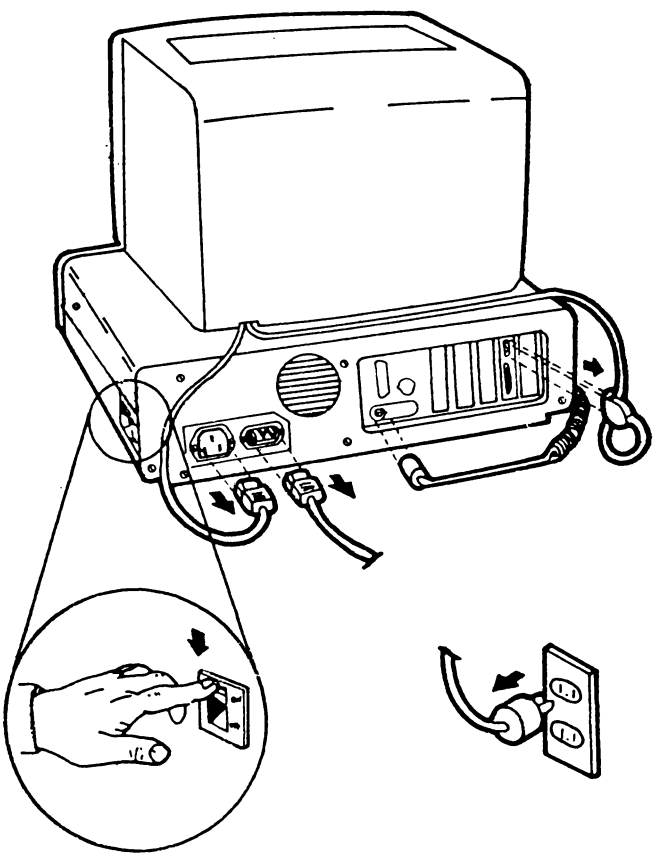
CHAPTER 2 OPTIONS

1. Position System Unit Switch to OFF.

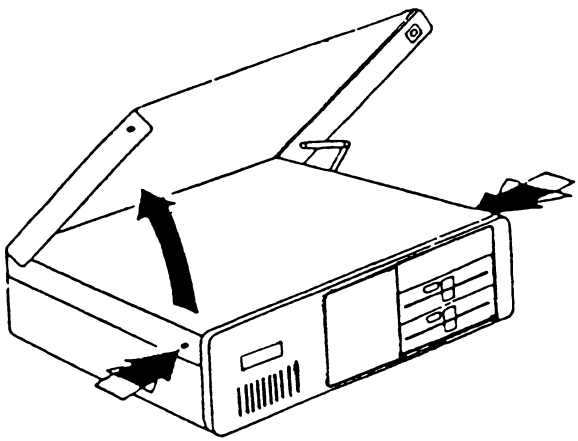
2. Position any external option power switches to OFF (such as printer, TV, cassette, etc.).

3. Unplug System Unit and all other options from wall outlet.

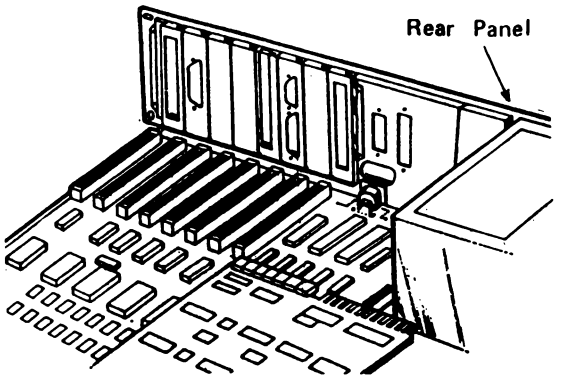
4. Disconnect all cabes plug in the rear of the System Unit.



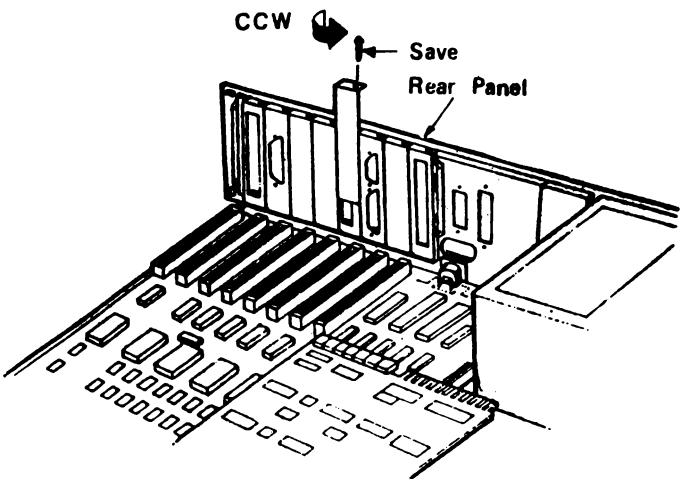
5. Set your keyboard and all external options in an area away from the system work surface.
6. Use your fingers to press in the buttons on the sides of the system Unit and then lift the cover up.



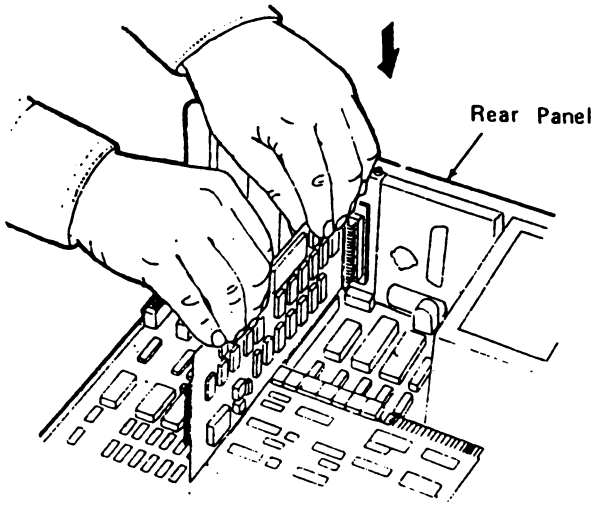
7. Look at the left rear panel. There are 8 system expansion slots, you may install your option in any one of the slots.



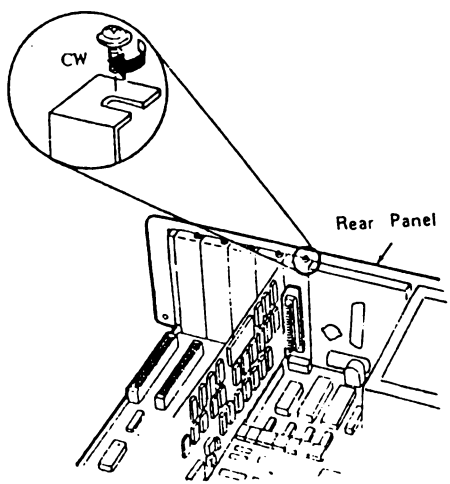
8. Use a Philips screw driver of a 1/8 nutdriver and loosen the screw, that holds the system expansion slot cover in place, by turning it counterclockwise (CCW).



9. Hold the option by the top corners and firmly press the option into any slot you like.



10. Use a Philips screwdriver of a 1/8" nutdriver and lock the screw, that hold the option. Then turn the screw clockwise (CW).



CHAPTER 3 OVERVIEW OF THE PC/XT SYSTEM

INTRODUCTION

The basic components of the PC/XT Personal Computer consist of the System Unit, the keyboard and the optional PC/XT DISPLAY MONITOR. It can be easily connected and ready to use, in a matter of minutes. Fig. 3-1 illustrates the major elements of a 16-bit SYSTEM. The System Unit contains the 16-bit microprocessor, the memory and one or two diskette drives housed in a single table-top unit. This unit is approximately 14.2cm high, 42.5cm wide, and 49cm deep.

The System Unit is powered from a standard 110-volt (or 220-volt) AC grounded wall outlet. Attached to the System Unit through a 6-foot, coiled, like telephone cable, was the PC KEYBOARD. The keyboard is not a rigidly attaching cable.

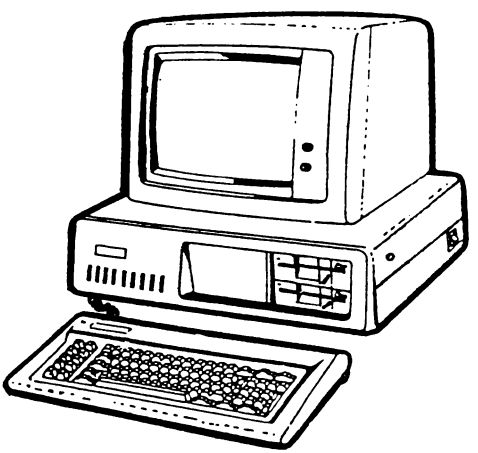


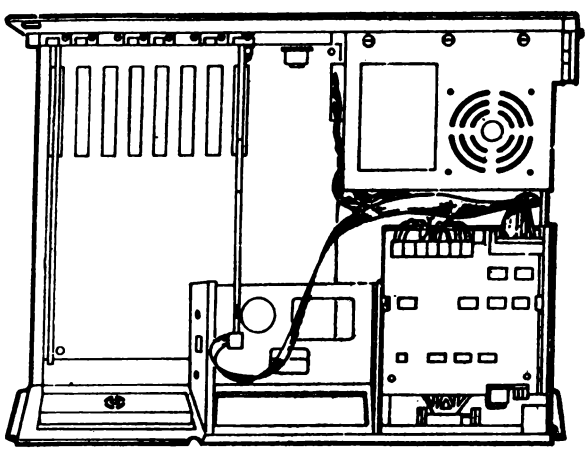
figure: 3-1

The display monitor attaches to the System Unit, via two cables – a power cable and a signal cable, but it obtains its power from a standard 110-volt (or 220 volt) AC wall outlet, or the power supply of the system unit.

THE SYSTEM UNIT

The System Unit contains the 16-bit microprocessor, the Read-Only Memory (ROM), the user or Random-Access Memory (RAM), the power supply, and a speaker for audio and music applications, plus eight for XT expansion slots, to allow easy expansion of the system. One or two diskette drives can also be mounted in the System Unit. Fig. 3-2 is the illustration inside the System Unit, after the cover has been lifted up.

REAR



FRONT

Figure: 3-2

THE MOTHER BOARD

The heart of the System Unit is the processor board, which fits horizontally in the base of the System Unit. The processor board contains much of the essential electronics of the system, including the 8088 microprocessor, up to 640 KB (kilobytes) of Random-Access Memory (RAM), 64KB of Read-Only Memory (ROM), I/O adapters for the keyboard, and audio speaker. The most important features of the mother board are the system-bus slots that allow additional features and interface devices to be added to the System Unit. Much of this manual will be devoted to describing the functions that are available at the system bus in these card slots. In Fig. 3-2, all of the feature cards have been removed so that the mother board is visible with its system-bus card slots shown empty.

THE POWER SUPPLY

The power supply is housed in the System Unit. It is shown at the top right corner in Fig. 3-2. This power supply provides Direct Current (DC) power to the elements of the System Unit. The power supply also provides AC power to the display monitor. This power supplys four DC power levels +5 volts and +12 volts. These power levels are available at the 8 system-bus slots and can be used by feature cards. A total of watts of DC power is available to the system and its features 150W.

THE DISKETTE DRIVES

The System Unit can house up to two 5-¼ inch double sided

floppy diskette drives with approximately 320KB of storage each drive. Thus, if two double-sided drives were installed in the System Unit, a total of 640 kilobytes of storage is available within the unit. To attach the two diskette drives, a diskette adapter must be installed in one of system-bus slots. The 16-bit PC/XT diskette-drive adapter has an external port that provides the signals for attaching two drives outside of the System Unit.

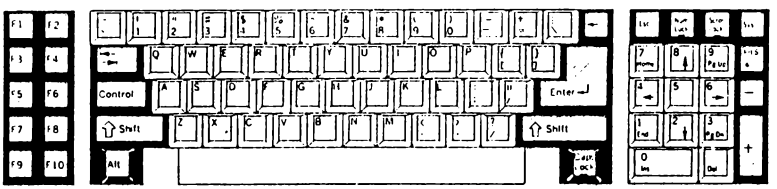
THE SPEAKER

Housed near the front left corner of the System Unit is a small audio speaker. The speaker is under program control and, typically, it is used as an alarm or as an output device for games and application programs that require an audio output.

THE SYSTEM KEYBOARD

The PC/XT KEYBOARD is an 84-Keys full-function keyboard with a central body similar to that of a standard typewriter keyboard. There are extra keys on each side of the standard typewriter section, however, on the left, there are two columns of 5 keys that are program function keys. The key functions are defined by the system or application program being executed in the system. On the right side of the keyboard, an array of keys are available that we are used to perform the dual functions of numeric data entry and cursor control. Fig. 3-3 is a picture of the system keyboard that clearly illustrates its layout. The keyboard interfaces to the

System Unit via a fourwire interface that contains both signal and power leads. The keyboard sends a unique 8-bit scan code on both a key depression and a key release. If a key is held down, the keyboard sends a scan code on the depression, pauses, and then sends the same scan code at a fixed typomatic rate until the key is released. Upon release of the key, a different scan code is sent. This function allows applications to define the mode of operation of the keyboard and, also, define the shift states and the typomatic functions of each key on the keyboard.



THE FEATURE CARDS

The PC/XT presently offers a set of feature cards that fit into the 8 system-bus slots to provide memory expansion, drive attachment, and standard interfaces for a variety of devices and purposes.

** COLOR GRAPHICS DISPLAY ADAPTER CARD **

This card provides the ability to attach a variety of TV-frequency monitors and display. It supports both monochrome and color in both text and graphic modes. In text mode, it supports either a 40x25 or a 80x25 display format. Also, in the text mode, each character is formed in an 8x8 character box, characters can be monochrome or they can be displayed in color with 8 background colors and 16 foreground colors. Each of the character in the text mode can also be made to blink, multiple pages of text may also be stored in the adapter, as four 80x25 screens or eight 40x25 screens.

The adapter card has two graphics modes — a 320x200 four-color mode and a 640x200 monochrome mode. In the 320x 200 mode, each dot on the screen can be programed with one of four colors. Two sets of four colors are available. The 640x200 mode is only supported in monochrome since all of the 16KB on-card memory is used to represent the ON, OFF state of the dots, leaving no memory to represent color information.

The graphics display adapter can support three different display interfaces — a direct drive, a composite video, and an RF modulator. The RF modulator interface allows through the use of an external RF modulator device, attachment to a standard home TV set. The adapter will also support a light pen input device.

The display adapter card contains a ROM character generator that provides 256 characters for display on the screen. In addition to the standard 96 ASCII characters, there are special

characters for supporting games and text processing, plus international characters and symbols, line graphics, and scientific notation and Greek characters.

The color graphics adapter card fits the System Unit and takes one of the system-bus card slots.

** MONOCHROME DISPLAY ADAPTER AND ** ** PARALLEL PRINTER PORT ADAPTER CARD **

This card is a combination adapter, supporting two function, the attachment of the PC/XT monochrome display and providing a parallel printer port. The display portion of this card supports a text only 80x25 screen format on the monochrome display. The character set is the same character set that is used on the color graphic adapter card, but it's styled in a larger font, to take advantage of the higher performance of the monochrome display, characters are formed in a 9x14 character box and each character can be highlighted, underlined, blinked, and reversed from green-on-black be used to attach to the monochrome display. In GRAPHICS mode, the bits is the buffer control the actual dots on the screen, screen patterns are formed by writting "1"S and "0"S to the buffer, the buffer is organized as two complete screens that can be alternately displayed. This feature makes it possible to compose one pattern while displaying another, which is particularly useful for animation the monochrome graphics with an enhanced function of 720x348 graphics on a monochrome monitor.

The parallel printer port portion of this card is identical to the

parallel printer port attachment card described elsewhere in this manual. This adapter card fits in the System Unit and uses one of the 8 system-bus card slots.

CHAPTER 4 SYSTEM BOARD INSTRUCTION

4-1 THE SYSTEM BOARD

The PC/XT system board fits horizontally in the base of the system unit and is approximately 8½x12 inches. It is a double sided P.C.B., DC power and a signal from the power supply enter the board through two six-pin connectors. Other connectors on the board are for attaching the keyborad and speaker. Eight 62-pin card edge-sockets are also mounted on the board. The I/O channel is bussed across these eight I/O slots.

A "Dual-in-Line Package"(DIP) switch (SWI) (one eight-switch pack) is mounted on the board and can be read under program control. The DIP switch provides the system software with information about the installed options, how much storage the system board has, what type of the display adapter is installed, what operation modes are desired when power is switched on (color or black-and-white, 80- or 40-character lines), and the number of diskette drive attached.

The system board consists of five functional area: the processor subsystem and its support elements, the Read-Only Memory (ROM) subsystem, the Read/Write (R/W) Memory subsystem, integrated I/O adapters, and the I/O channel. All are desired in this section.

The heart of the PC/XT system board is the Intel 8088 microprocessor. This processor is an 8-bit external bus version of

Intel's 16-bit 8086 processor, and it's software-compatible with the 8086. Thus, the 8088 supports 16-bit operations, including multiply and divide, and supports 20 bits addressing (1 megabyte of storage). It also operates in a maximum mode, so a coprocessor can be added as a feature. The processor operates at 4.77 MHz. This frequency, which is derived from a 14.318 MHz crystal, is divided by 3 for the processor clock, and by 4 to obtain the 3.58 MHz color burts signal required for color televisions.

At the 4.77 MHz colck rate, the 8088 bus cycles are four clocks or 1.05 microseconds.

The processor is supported by a set of high-function devices providing four channels of 20-bit Direct-Memory Access (DMA), three 16-bit timer-counter channels, and eight prioritized interrupt levels.

Three of the four DMA channels are available on the I/O bus and support high speed data transfers between I/O devices and memory without processor intervention. The fourth DMA channel is programmed to refresh the system dynamic memory. This is done by programing a channel of the timer-counter device to periodically request a dummy DMA transfer. This action creates a memory-read cycle, which is available to refresh dynamic storage, both on the system board and in the system expansion slots. All DMA data transfers, except the refresh channel, take five processor clocks of 210 ns, or 1.05, μs if the processor-ready line is not deactivated. Refresh DMA cycles take four clocks or 840 ns.

The three programmable timer/counters are used by the system as follows: Channel 0 is used as a general purpose timer,

providing a constant time base for implementing a time-of-day clock; Channel 1 is used to time and request refresh cycles from the DMA channel; and Channel 2 is used to support the tone generation for the ausio speader. Each channel has a minimum timing resolution of 1.05μs.

Of the eight prioritized levels of interrupt, six are bussed to the system expansion slots for use by features cards. Two levels are used on the system board. Level 0, the highest priority, is attached to Channel 0 of the timer/counter and provides a periodic interrupt for the time-of-day clock. Level 1 is attached to the keyboard adapter circuits and receives an interrupt for each scan code sent by the keyboard. The Non-Maskable Interrupt (NMI) of the 8088 is used to report memory parity errors.

The system board supports both ROM/EPROM and R/W memory. It has space for 64K x 8 of ROM or EPROM. This ROM contains the power-on self-test, I/O drivers, dot patterns for 128 characters in graphics mode, and a diskette and has an access time and a cycle time of 250 ns each.

The system board also has from 128K to 256K of R/W memory. A minimum system would have 128K of R/W memory. A minimum system would have 128K of memory, with module sockets for an additional 128K. Memory greater than the system boards maximum of 256K is obtained by adding memory cards in the expansion slots. The memory consists of dynamic 64K 1 chips with an access time of 200 ns and a cycle time of 345 ns. All R/W memory is parity checked.

The system board contains the adapter circuits for attaching the serial interface from the keyboard. These circuits generate an interrupt on to the processor, when a complete scan code is received. The interface can request execution of a diagnostic test in the keyboard.

The keyboard interface is a 5-pin DIN connector on the system board, that extends through the rear panel of the system unit.

The system units has an 2¼ inch audio speaker. The speaker's control circuits and driver are on the system board. The speaker connects through a 2-wire interface that attaches to a 3-pin connector on the system board.

The speaker drive circuit could be capable of providing approximately ½ watt of power. The control circuits allow the speaker to be driven three different ways: 1) a direct program control register bit may be toggled, to generate a pulse train; 2) the output from Channel 2 of the timer counter, may be programed to generate a waveform to the speaker; 3) the clock input to the timer counter, can be modulated with a program controlled I/O register bit. All three methods may be performed simultaneously.

4-2 I/O Channel

The I/O channel is an extension of the 8088 microprocessor bus. It is, however, demultiplexed, repowered, and enhanced by the addition of interrupts and Direct Memory Access (DMA) functions.

The I/O channel contains an 8 bit, bidirectional data bus, 20 address lines, 6 levels of interrupt, control lines for memory and I/O read or write, clock and timing lines, 3 channels of DMA control lines, memory refresh timing control lines, a channel check line, and power and ground for the adapters. Four voltage levels are provided for I/O card: +5 Vdc, −5 Vdc, +12 Vdc, and −12Vdc. These functions are providcded in a 62-pin connector with 100-mil card tab spacing.

A "ready" line is available on the I/O channel, to allow operation with slow I/O or memory devices. If the channel's ready line is not activated by an addressed device, all processor-

generated memory read and write cycles takes four 210-ns clock or 840-ns/byte. All processor-generated I/O read and write cycles require five clocks for a cycle time of 1.05μs/byte. Refresh cycles occur once every 72 clocks (approximately 15μs) and require four clocks or approximately 7% of the bus bandwidth.

I/O devices are addressed using I/O mapped address space. The channel is designed so that 768 I/O device addressed are available to the I/O channel cards.

A channel check line exists for reporting error conditions to the processor. Activating this line results in a Non-Maskable Interrupt (NMI) to the 8088 processor. Memory expansion options use this line to report parity errors.

The I/O channel is repowered, to provide sufficient drive, to power all eight (J1 through J8) expansion slots, assuming two Low-Power Sohorttky (LS) loads per slot. The I/O adapters typically use only one load.

4-3 I/O Channel Description

The following is a description of the PC/XT I/O Channel. All lines are TTL-compatible.

Singal I/O Description:

OSC, Oscillator:
High; speed clock with a 70-ns period (14.31818 MHz). It has a 50% duty cycle.

CLK, System Clock:
It is divide-by-three of the oscillator and has a period of 210 ns (4.77 MHz). The clock has a 33% duty cycle.

RESET:
This line is used to reset or initialize system logic upon power-up or during a low line voltage outage. This signal is synchronized to the falling edge of clock and is active high.

A0-A19, Address Bits 0 to 19:
These lines are used to address memory and I/O devices within the system. The 20 address lines allow access of up to 1 megabyte of memory. A0 is the Least Significant Bit (LSB) and A19 is the Most Significant Bit (MSB). These lines are generated by either the processor or DMA controller. They are active high.

D0-D7, I/O Data Bits 0 to 7:
These lines provide data bus bits 0 to 7 for the processor, memory, and I/O devices. D0 is the Least Significant Bit (LSB) and D7 is the Most Significant Bit (MSB). These lines are active high.

ALE, Address Latch Enable:
This line is provided by the 8288 Bus Controller and is used on the system board to latch valid addresses from the processor. It is available to the I/O channel as an indicator of a vilid processor address (when used with AEN). Processor addresses are latched with the failing edge of ALE.

I/O CH CK, I/O Channel Check:
This line provides the processor with parity (error) information on memory or devices in the I/O channel. When this

signal is active low, a parity error would indicated.

I/O CH RDY, I/O Channel Ready:
This line, normally high (ready), can be pulled low (not ready, by a memory or I/O device to lengthen I/O or memory cycles. It allows slower devices to attach to the I/O channel with a minimum of difficulty. Any slow device using this line should drive it low immediately upon detecting a valid address and a read or write command. This lines should never be held low, longer than 10 clock cycles. Machine cycles (I/O or memory) are extended by an integral number of CLK cycles (210 ns).

IRQ2-IRQ7, Interrupt Request 2 to 7:
These lines are used to signal the processor, that a I/O device requires attention. They are prioritized with IRQ2 as the highest priority and IRQ7 as the lowest. An Interrupt Request are generated by raising an IRQ line (low to high) and holding it high, until it was acknowledged by the processor (interrupt service routine).

IOR, I/O Read Command:
This command line instructs an I/O device to drive its data onto the data bus. It may be driven by the processor or the DMA controller. This signal is active low.

IOW, I/O Write Command:
This command line instructs an I/O device, to read the data on the data bus. It may be driven by the processor or the DMA controller. This signal is active low.

MEMR, Memory Read Command:
This command line instructs the memory to drive its data into the data bus. It may be driven by the processor or the DMA

controller. This signal is active low.

MEMW, Memory Write Command:
This command line instructs the memory to store the data present on the data bus. It may be driven by the processor or the DMA controller. This signal is active low.

DRQ1-DRQ3, DMA Request 1 to 3:
These lines are aynchronous channel requests used by peripheral devices to gain DMA service. They are prioritized with DRQ3 being the lowest and DRQ1 being the highest. A request is generated by bringing a DRQ line to an active level (high). A DRQ line must be held high until the corresponding DACK line goes active.

DACK0 – 3 – DMA Acknowledge 0 to 3:
These lines are DACK3 used to acknowledge DMA requests (DRQ1-DRQ3) and to refresh system dynamic memory (DACKO). They are active low.

AEN, Address Enable:
This line is used to degate the processor and other devices from the I/O channel to allow DMA transfers to take place. When this line is active (high), the DMA controller has control the address bus, data bus, read command lines (memory and I/O), and the write command lines (memory and I/O).

T/C, Terminal Count:
This line provides a pulse when the terminal count for any DMA channel is reached. This signal is active high.

CARD SLCTD, Card Selected:
This line is activated by cards in expansion slot J8. It signals,

"THE SYSTEM BOARD", that the card has been slected and that appropriate drivers on the system board should be directed to either read from, or write to, expansion slot J8. Connectors J1 through J8 are tied together at this pin, but the system board should be driven by an open collector device.

The following voltages are available on the system board I/O channel:

+5 Vdc +— 5%, located on 2 connector pins
—5 Vdc +—10%, located on 1 connector pin
+12 Vdc +— 5%, located on 1 connector pin
—12 Vdc +—10%, located on 1 connector pin
GND (Ground), located on 3 connector pins

4-3 Speaker Interface

The sound system has a small, permanent-magnet, 2¼ inch speaker. The speaker can be driven from one or two sources:

* An 8255A-5 PPI output bit. The address and bit are defined in the "I/O Address Map".

* A timer clock channel, the output of which is programmable within the founctions of the 8253-5 timer when using a 1.19-MHz clock input. The timer gate also is controlled by an 8255A-5 PPI output port bit. Address and bit assignment are in the "I/O Address Map".

The speaker connection is a 4-pin berg connector. See "System Board Component Diagram", earlier in this section, for speaker connection or placement.

4-5 The system board Switch Setting

The DIP Switch (SW1) located at U20 is used to set the system configuration and specify the amount of memory installed on the system board.

Position	Function
1	Normal operation off
2	Use for 8087 co-processor
3-4	Always OFF
5-6	Type of display adapter
7-8	Number of 5¼ inch diskette drives

Switch (SW1):
1=OFF (NORMAL OPERATION)
2=ON W/O 8087 co-processor
2=OFF W/ 8087 co-processor

Memory Switch Settings:

3=OFF	4=ON	128K	MEMORY INSTALLED
3=ON	4=OFF	192K	MEMORY INSTALLED
3=OFF	4=OFF	256K	MEMORY INSTALLED

Display Adapter Switch Settings:

5=ON	6=ON	NO DISPLAY ADAPTER
5=OFF	6=ON	COLOR/GRAPHICS (40x20 Mode)
5=ON	6=OFF	COLOR/GRAPHICS (80x25 Mode)
5=OFF	6=OFF	MONOCHROME DISPLAY ADAPTER OR BOTH

Diskette Dirve Switch Setting:

7=ON	8=ON	1 DRIVE INSTALLED
7=OFF	8=ON	2 DRIVES INSTALLED
7=ON	8=OFF	3 DRIVES INSTALLED
7=OFF	8=OFF	4 DRIVES INSTALLED

4-6 Hardware Reset Jumper: (JP1)

If use a S.W. (i.e. normal open) to connect Jumper 1, when push s.w. (i.e. short), the system board hardware will be reseted.

Note:
Press and hold down the Ctrl (Control) and Alt (Alternate) keys and then press the Del (Delete) key, then release all three, this operation is called software reset.

4-7 Some Trouble Shooting Points

This section give some hints to experienced engineers and technicians to test and bring up the system board.

1) System Clock:
   4.77 MHz at U1 (8284A) PIN 8 and U3 (8088) PIN 10, etc., with 33% duty cycle. If no system clock, check Y1 (14.318 MHz) crystal, U1.
2) Power Up Reset:
   When Power up U3 (8088) PIN 21 should go high then back to low again. If no power up, please check jumper on JP1.
3) Memory Decoding Circuit:
   When power up, the processor will start execute the program through ROM 7 (BIOS & Self test). The CS7 — line should see a train low again pulses to fetch instruction

from the ROM 7. If no pulses on CS7 — on U23 (LS138 PIN 7), check the memory decoding circuit and make sure the ROM/EPROM Jumpers (W1-W12) are in the right position.

4) RAM Refresh:
The RAM is being refresh using the timer chip U49 (8253-5 PIN 13 OUT 1) to trigger the chip (8237A-5) DRQO, and the DMA chip will send out a dummy address to refresh the dynamic RAMs (4164). If no periodic low pulses on RAM chip PIN 4 (RAS–), check the TIMER, DMA, and refreshing circuit.

5) R.T.C. Circuit:
A square wave is generated through TIMER/COUNTER CHIP (8253-5U49) PIN 10 (OUT 0), and then interrupt the processor through 8259A PIN 17 (INT Signal) for the R.T.C. Timing.

6) Keyboard Circuit:
The keyboard data input is through keyboard connector PIN 2 and U22 (LS322) to convert the serial data to parallel and read by 8255A-5 (U37) port A. Interrupt 1 (ITQ 1) is used to inform the processor, that a key had been pressed. If no keyboard response, check U52 (74LS74), U22 (LS 322), and U37 (8255A-5).

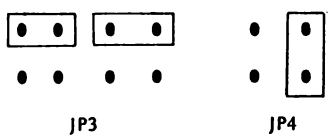
NOTE: The PC/XT system board will run with the IBM XT ROM set (32Kx8), but will not run with the IBM PC ROM set (8Kx8).

4-8 HOW TO CHANGE THE SYSTEM BOARD MEMORY

The system board provides two options of memory RAM installed: (1) 256K RAM memory (2) 640K RAM memory. the user can select one of two options according to his application. Once the option is decided, follow the instructions list below carefully. Be sure to turn power off before you follow instruction.

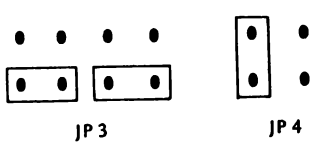
OPTION (1) 256K RAM ON SYSTEM BOARD:

(A) Make sure that U95B and U100 there are nothing but sockets.
(B) Plug 36 pcs 4164 RAM cell into 36 sockets of Bank o through Bank 3.
(C) Set JP3 and JP4 as indicated below:



OPTION (2) 640K RAM ON SYSTEM BOARD:

(A) Put 24S10 into U95B socket, 74S157 into U100 socket respectively.
(B) Put 18 pcs 41256 RAM cell into 18 sockets of Bank 0 and Bank 1. then put 18 pcs 4146 Ram cell into 18 sockets of Bank 2 and Bank 3.
(C) Ste JP3 and JP4 as following



CHAPTER 5 KEYBOARD USE

5-1 INTRODUCTION

The PC's keyboard has a permanently attached cable that connects to a 5-pin DIN connector, which is connected to the computer system. This shielded at less than four-wire cable has power (+5 Vdc), gound, and two bidirectional signal lines.

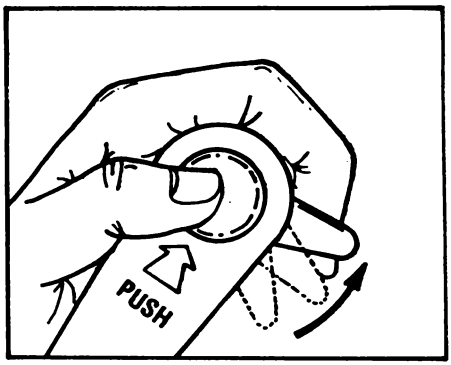
The cable is more than 6-feet long and is coiled like a telephone headset.

This keyboard uses silicon rubber technology with a microcomputer (Intel 8748) performing the keyboard scan function. The keyboard has two tilt positions for the operator to be very comfortable.

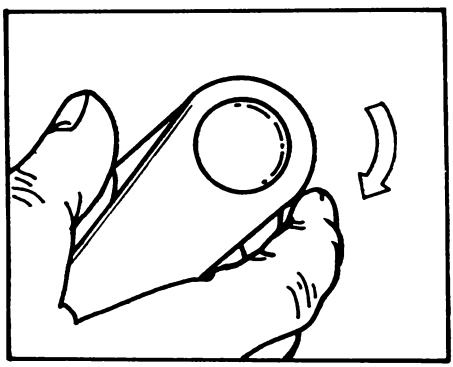
The keyboard has 84 keys, arranged in three major groupings. The central portion of the keyboard is like a standard typewriter keyboard layout. On the left side are ten function keys are userdefined by sodtware. On the right is a fifteen keypad. Those keys are also defined by software, but have legends for the functions of numeric entry, cursor control. calculator pad, and screen edit.

The keyboard interface is designed so that the system software has maximum flwxibility in defining certain keyboard operations. This is accomplished by having the keyboard return scan coded, rather than American Standard Code for Information Interchange (ASCII) codes. In addition, all keys are typematic and generate both a make and a break scan code.

KEYBOARE
ADJUSTMENT

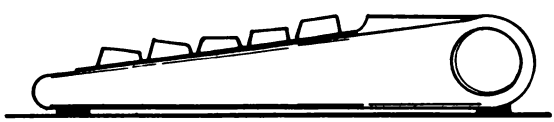


There is one adjustable leg located at each end of the keyboard, there-by offering the option between two positions to ensure typing comfort.

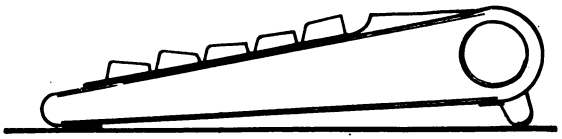


Pull back the adjustable leg.

CAUTION: HOLD KEYBOARD WHEN CHANGING POSITON



Keyboard in tilt position.

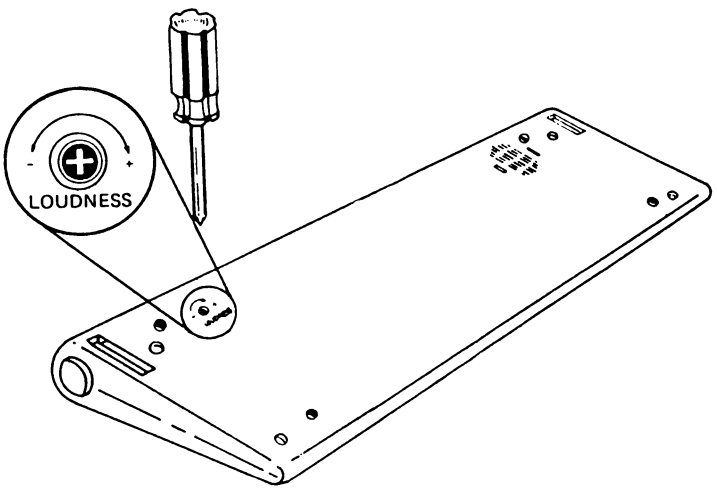


Keyboard in lever position.

See catalog, when any key is presseed, the keyboard generates a short beep.

In this keyboard, the key-beep loudness can be just controlled by turning the loudness control screw with a philips screw driver.

The loudness switch screw is just in the back of keyboard.

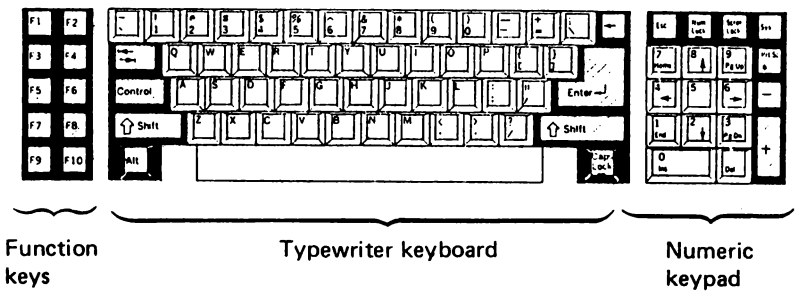


This keyboard is divided into three general areas:

(1) 10-function keys, from F1 through F10, are on the left side of the keyboard.

(2) "Typewriter" area is in the middle. That is where you find the regular letter and number keys.

(3) The numeric keypad, similar to a calculator keyboard, is on the right side of the keyboard.



5-2 FUNCTION KEYPAD

The function keypad is designed to relieve you of repetitive entry of typed commands and control functions. The single key entry replaces these actions as described below.

F1: LIST ฿	F6 : "LPT1
F2: RUN	F7 : TRON
F3: LOAD"	F8 : TROFF
F4: SAVE"	F9 : KEY ฿
F5: CONT	F10: SCREEN 0,0,0

Remarkes: 1) ฿ means blank space.
2) ↵ means return.

5-3 NUMERIC KEYPAD

1. Num Lock

Usually you will be using the numeric keypad keys for their functions with the program editor. These keys allow you to move the cursor up, down, right, and left. But you can use the Num Lock key to set the numeric keypad so it works more like a calculator keypad. Pressing the Num Lock key shifts the numeric keypad into its own upper-shift mode, so that you get thenumbers 0 through 9 and the decimal point, as indicated on the keycaps. Pressing Num Lock again will return the keypad to its normal cursor control mode. As with Caps Lock, you can temporarily reverse the Num Lock state by pressing one of the Shift Keys. Besides, the NUM LOCK's LED indictor will light when the keyboard is in numeric keypad state.

2. Cursor-Up ↑

Moves the cursor one position up.

3. **Cursor-Down ↓**

   Moves the cursor one position down.

4. **Cursor Left ←**

   Moves the cursor one position left. If the cursor advances beyond the left edge of the screen, the cursor will move to the right side of the screen on the proceeding line.

5. **Cursor Right →**

   Moves the cursor one position right. If the cursor advances beyond the right edge of the screen, the cursor will move to the left side of the screen on the next line dwon.

6. **Home**

   Moves the cursor to the upper left-hand corner of the screen. When press both Ctrl and Home keys, clears the screen and positions the cursor in the upper lefthand corner of the screen.

7. **End**

   Moves the cursor to the end of the logical line. Also. when press both Ctrl and End keys, erases to the end of logical line from the current cursor position. All physical screen lines are erased until the terminating Enter is found.

8. **PgUp**

   Under the program Editors and Word processors comment,

press both Ctrl and PgUp can top of document and home cursor.

9. PgDn

Under the program Editors and Word processors comment, press PgDn key can scroll forward 25 lines and home cursor. And when press both Ctrl and PgDn can delete from cursor to EOS (End of Screen) under the Test.

10. Ins

Sets insert mode. If insert mode is off, then pressing this key will turn it on. If insert mode is already on, then you will turn it off when you press this key. When you are in insert mode, the cursor covers the lower half of the character position.

When insert mode is on, characters above and following the cursor move to the right as typed characters are inserted at the current cursor position. After each keystroke, the cursor moves one position to the right. Line folding occurs; that is, as characters advance off the right side of the screen they return on the left on a subsequent line.

When insert mode is off, any characters typed replace existing characters on the line.

Besides pressing the Ins key again, insert mode will also be turned off when you press any of the cursor movement keys or the Enter Key.

11. Del

Deletes the character at the current cursor position. All characters to the right of the deleted character move one position left to fill in the empty space. Line folding occurs; that is, if a logical line extends beyond one physical line, characters on subsequent lines move left one position to fill in the previous space, and the character in the first column of each subsequent line moves up to the end of the proceeding line.

5-4 THE MAIN KEYBOARD

The typewriter area of the keyboard behaves much like a standard typewriter. All the letters are there, in their usual places. The numbers 0 through 9 are on the top row, along with some special characters. Capital letters and the special characters shown above the numbers on the number keys are displayed by holding down either of the Shift keys and pressing the desired key. The functions of some special keys are descrived as belows.

1. Caps Lock

This keyboard does not have a normal Shift Lock key. The Caps lock key is similar to a Shift Lock key, but it only gives you capital letters, and will not give you the uppershift characters on the numeric or other keys. After you press this key, you will continue to get capital letters until you press it again. You can get lowercase letters when in Caps Lock state by pressing and holding one of the Shift keys. When you release the Shift key, you will

go back to Caps Lock state. Besides, the LED indicator will light when Caps is on.

2. **Alt**

The Alt key enables easy entry of BASIC statement keywords. This key allows you to type an entire BASIC keyword with a single keystroke.

The BASIC keyword is typed when the Alt key is hold down while one of the alphabetic keys A — Z is pressed. Keywords associated with each letter are summarized below. Letters not having reserved words are noted by 'NO ORED'.

A	AUTO	M	MOTOR
B	BSAVE	N	NEXT
C	COLOR	O	OPEN
D	DELETE	P	PRINT
E	ELSE	Q	NO WORD
F	FOR	R	RUN
G	GOTO	S	SCREEN
H	HEXS	T	THEN
I	INPUT	U	USING
J	NO WORD	V	VAL
K	KEY	W	WIDTH
L	LOCATE	X	XOR

3. **Shift**

Capital letters and the special characters shown above the numbers on the number keys are displayed by holding

down either of the Shift keys and pressing the desired key.

4. **Ctrl**

As Ctrl key always used with another key to perform a command or function, below are examples of the functions.

1) **Ctrl-G**
Bell. When press these two keys, the speaker beeps.

2) **Ctrl-Scroll Lock**
Break. This stops your program while it is running and identifies the line where the program stopped.

3) **Ctrl-Num Lock**
Pause. This stops your program; press any key to continue.

4) **Ctrl-**
Next Word. Moves the cursor right to the next word on the line.

5) **Ctrl-**
Previous Word. Moves the cursor left to the previous word on the line.

6) **Ctrl-Home**
Clear Screen. Removes all information on the screen and moves the cursor to the upper left corner.

7) **Ctrl-Alt-Del**
System Reset. Holding both the Ctrl and the Alt

keys down, then press the Del dey reloads your system or program diskette (An error will appear if you have a data diskette loaded.)

8) **Alt - Esc**
When switch on the power of your computer, the keyboard buzzer will work automatically and generate a sound when you press a key. But you can press this two key to switch off the buzzer. If you repeat to press this key again, then the buzzer will automatically work again.

5. **Tab**

Moves the cursor to the next tab stop. Tab stops occur every eight character positions; that is, at positions 1, 9, 17, etc.

When insert mode is off, pressing the Tab key moves the cursor over charcters until it reaches the next tab stop.

When insert mode is on, pressing the Tab key inserts blanks from the current cursor position to the next tab stop. Line folding occurs as explained under Ins.

6. **Esc**

When pressed anywhere in the line, erases the entire logical line from the screen. The line is not passed to BASIC for processing. If it is a program line, it is not erased from the program in memory.

7. **Backspace**

The Backspace key behaves somewhat differently from the Backspace key on a typewriter. It not only backspeces, it erases what you have typed as well. You should use the Cursor Left key to avoid erasing what you have typed. Besides, all characters to the right of the deleted character move left one position to fill in the space. Subsequent characters and lines within the current logical line move up as with Del key.

8. **Enter**

The key with the symbol on it is the carriage return key. You usually have to press this key to enter information into the computer. Wer will refer to it as the Enter key from now on.

9. **PrtSc**

* Below the Enter key is a key labeled PrtSc on top and * on the bottom. 'PrtSc' stands for 'Print Screen'. When the keyboard is in lowershift, pressing this key causes an asterisk to be typed. In uppershift, however, this ia a special key that causes a copy of what is on the screen to be printed on the printer (LPT 1:). So, if you ever need a hard (printed) copy of what is currently being displayed, just press and hold one of the Shift keys, and press the PrtSc key. (Note: Characters which are unrecognizable by the printer are printed as blanks.)

10. Scroll Lock

When press both Ctrl and Scroll Lock, interrupts program execution at the next Basic instruction and returns to Basic command level. It is also used to exite AUTO line numbering mode.

11. Special Symbols

This keyboard has some special symbols that you won't find on a regular typewriter, like∧, (and); and some characters are not where you might expect them to be if you are used to using a typewriter. For example, the uppershift period (.) is not a period, but is > symbol.

UNDER BASIC KEYBOARD USAGE

ESC	"ESCAPE" removes the list line that the cursor is on for corrections, but the line is not deleted from memory.
⇤ ⇥	"TAB" performs a tab function similar to a typewriter. Tabs are set every 8 characters.
CTRL	"CONOTROL" key is always used with another key to perform a command or function
⇧	"SHIFT" changes lower case letters to capitals.
ALT	"ALTERNATE" is used with alpha typing keys to eneter BASIC key words.
←	"BACK SPACE" key removes cursor to the left and removes one character for each key stroke.
↵	"RETURN" (ENTER) removes the cursor from the last character on one line to the first character of the next line.
F1	"LIST" displays the lines of your program on the screen.
F2	"RUN" causes your program to begin execution from the beginning of the program.
F3	"LOAD" reads your program from auxiliary storage and stores it in main memory.
F4	"SAVE" stores your program on auxiliary storage.
F5	"CONT" restarts your program after you have interrupted it by a STOP or CTRL BREAK.
F6	"LPTI:" refers to line printer and transfers data from screen to printer.
F7	"TRON" means trace on and causes the line numbers of program lines to be displayed as the lines are executed.
F8	"TROFF" means trace off and cancels command TRON.
F9	"KEY" is used to change the function of other function keys.
F10	"SCREEN" returns program to character mode from graphics mode and turns off color.

NUM LOCK ACTIVATE

1 thru 9	With "NUM LOCK" activated ONE through NINE will be operative.
DEL	"DECIMAL POINT" is used with numeric keypad.
0 INS	"ZERO" is used with numeric keypad.
—	"MINUS" is used with the numeric keypad.
+	"PLUS" is used with the numeric keypad.

NUM LOCK ACTIVATELESS

7 HOME	"HOME" removes the cursor the first character of the top line of the screen.
8	Moves the cursor one line up for each key stroke.
2	Moves the cursor down one line for each key stroke.
4	Moves the cursor to the right one character for each key stroke.
6	Moves the cursor to the left one character for each key stroke.
1 END	"END" moves the cursor to the last character on that line.
DEL	"DELETE" the character where the cursor is positioned.
0 INS	"INSERT" sets the keyboard to insert mode so that keys will be entered at the position of the cursor and all data to the right will move to the right. Pressing "INSERT" key again to exit insert mode.
CAPS LOCK	This is a toggle key: pressing the key will cause letters to type in upper case, pressing the key again will return lower case.
Prt Sc *	"PRINT SCREEN" will print an *. When pressed with the "SHIFT" key it will print all data on screen.
SCR LOCK	"SCROLL LOCK" is an inactive key.

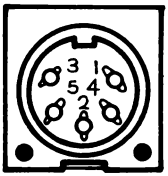
* CTRL + SCROLL LOCK/BREAK = BREAK
* CTRL + NUM LOCK = PAUSF
* CTRL + = TAB
* CTRL + = REVERSE TAB
* CTRL + HOME = CLEAR SCREEN
* CTRL + ALT + DEL = SYSTEM RESET

UNDER DOS KEYBOARD USAGE

F1	Redisplays previously entered line, a character at a time.
F2	Enter F2 followed by a character. Screen will redisplay all of the previously entered line up to the character you entered.
F3	Redisplays entire previously entered line.
F4	Enter F4 followed by a character. Screen will skip all of the characters in the previously entered line up to the character you entered.
F5	Saves the currently displayed line for further editing.

* CTRL + NUM LOCK	= SUSPEND
* CTRL + PRT SC	= ECHO
* CTRL + SCR LOCK/BREAK	= BREAK

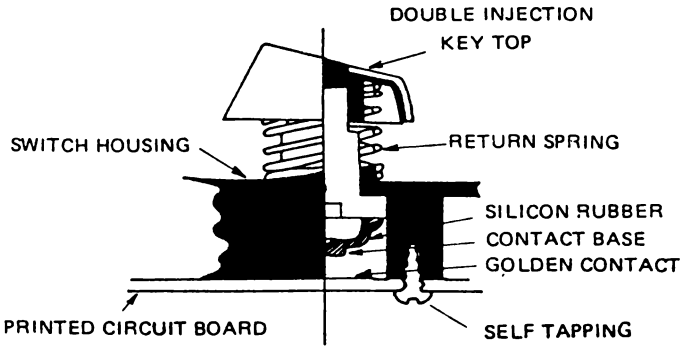
KEYBOARD CONNECTOR



5-Pin DIN Connector

Pin	TTL Signal	Signal Level
1	Keyboard Clock	+5 Vdc
2	Keyboard Data	+5 Vdc
3	Keyboard Reset (Not used by Keyboard)	
4	Ground	0
5	+5 Volts	+5 Vdc

KEY SWITCH INFORMATION



SPECIFICATIONS:

Total Travel:	.148" (3.8mm)
Pretravel:	.74 (1.9mm)
Operating Force:	Normal 60g
Operating Life:	Ten-million operating or more
Contact Resistor:	500 Ohm or less
Bounces:	5 msec or less

CHAPTER 6 COLOR GRAPHICS ADAPTER

6-1 FEATURES

1. Attachable to the color monitor, television-frequency monitor, or thome television sets (user-supplied RF modulator is required for home television sets).

2. Capable of operating in black-and-white or color mode. In the color mode, up to sixteen for foreground and eight background colors are available, in black-and-white mode, the character attributes of reverse video, blinking, and highlighting are available.

3. Two Operating Mode:
   Alphanumeric Mode:
   40 column x 25 rows for low-resolution monitor or home television.
   80 column x 25 rows for high-resolution monitor.
   Graphics Mode:
   320 dots x 200 rows for high-resolution monitor.
   640 dots x 200 rows for high-resolution black-and-white graphics mode.

4. Implementing a Motorola 6845 CRT controller, and contains 16K bytes of storage.

5. Three video interfaces:
   A composite-video port, a direct drive port, and a connection interface for driving a usersupplied RF modulator.

6. A light pen interface is provided.

6-2 COLOR GRAPHICS ADAPTOR PROGRAMMING REFERENCE

This section provides information required for programming the color graphics adaptor.

It can be used in conjunction with the I/O port map for this board.

1. Initialization
   Reset the video enable bit of the mode register (Port 3D8, Bit 3). Next, program the CRT controller chip (Ports 3D4 and 3D5) for the desired operation. Finally, program the mode and color registers (Ports 3D8 and 3D9).

2. Mode Register Programing

Video Mode	Mode Byte
40 x 25 Alpha B & W	2CH
40 x 25 Alpha Color	28H
80 x 25 Alpha B & W	2DH
80 x 25 Alpha Color	29H
320 x 200 Graphics B & W	0EH
320 x 200 Graphics Color	0AH
320 x 200 Graphics B & W	1EH

   Note: To control high intensity of background using the blinking attributed in alpha modes, clear Bit 5 of the mode byte. Since Bit 3 of all mode bytes is set, the video will be enabled when the mode is programmed.

3. Color Register Programming

Bit 0 — Selects blue as a border in 40 x 25 alpha mode or as a background color in 320 x 200 color graphics mode.

Bit 1 — Selects green as a border color in 40 x 25 alpha mode or as a background color in 320 x 200 graphics mode.

Bit 2 — Selects red as a border color in 40 x 25 alpha mode or as a background color in 320 x 200 color graphics mode.

Bit 3 — Intensifies the border color in 40 x 25 alpha mode or background color in 320 x 200 color graphics mode.

The above bits define the following colors:

0000 = Black	0110 = Brown	1100 = Lt Red
0001 = Blue	0111 = Lt Gray	1101 = Lt Magenta
0010 = Green	1000 = Dk Gray	1111 = Yellow
0011 = Cyan	1001 = Lt Blue	1111 = White
0100 = Red	1010 = Lt Green	
0101 = Magenta	1011 = Lt Cyan	

Bit 4 — Intensifies the background colors in the alpha mode.

Bit 5 — Selects the pallette for 320 x 200 color Graphics mode. The pallette defines the color produced by each value of the pixel (C1, C0) for that point on the screen.

If Bit 5 = 1			If Bit 5 = 0		
C1	C0	Color	C1	C0	Color
0	0	Background Color	0	0	Background color
0	1	Cyan	0	1	Green
1	0	Magenta	1	0	Red
1	1	White	1	1	Brown

4. Status Register Interpretation
   The status register (Port 3DA) of the color graphics video board is used for video buffer access timing and light pen testing.

   Bit 0 — This bit is high when the video disply is blanked during a sync interval. In 80 x 25 alpha mode, the video buffer should not be accessed by the CPU unless this bit is high or the access will produce interference in the form of a short horizontal line on the display.

   Bit 1 — Indicates that a rising edge from the light pen switch has set the light pen trigger. This status may be cleared or set by out-putting any data byte to ports 3DB or 3BC respectively.

   Bit 2 — If 0, indicates the light pen switch is on. Switch is not debounded or latched.

   Bit 3 — This signal is high during the vertical sync interval of the display.

5. Video Buffer Organization
   The video buffer consists of 16K bytes of RAM located at B8000-BBFFF.

The format of data in the memory is different from each type of display mode.

80 x 25 Alpha Modes

Display-character code Byte								Attribute Byte							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

Each character position is defined by two consecutive bytes in the video buffer. The first byte is the ASCII character code, and the second byte is the attribute. The screen holds 2000 characters which requires 4,000 bytes. Consecutive locations in the buffer located at the upper left corner of the screen. The 256 character patterns are generated by a 2K byte ROM on the Color/Graphics Adaptor. It defines the character as a 7 x 7 pattern in an 8 x 8 box. The attribute byte is defined as follows:

Bit 0 — Blue Character
Bit 1 — Green Character.
Bit 2 — Red Character
Bit 3 — Intensify Character
Bit 4 — Blue Background
Bit 5 — Green Background
Bit 6 — Red Background
Bit 7 — Blinking Character

Bit 7 Can be redefined to intensify background by setting Bit 5 of the mode register.

For black and white modes, select black by turning all colors off and white by turning all colors on.

40x25 Alpha Modes

These modes are similar to the 80 x 25 alpha modes except that the screen only holds 1,000 characters and therefore required 2,000 bytes.

320 x 200 Graphics

This mode uses 16,000 bytes of memory, organized a 4 pixels horizontally per byte. The screen is divided into two buffers, the first holding data for the even scan lines (0, 2, 4 . . . . 198) at addresses B8000-B9F3F and the second holding data for the odd scan lines (1, 3, 5, ... 199) at addresses BA000-BBF3F. Each pixel is defined by 2 bits, with the top left corner of the screen being B7 and B6 of the first byte. Each line consists of 320 pixels, which is defined by 80 consecutive bytes in the buffer. The color of the displayed pixel is selected from the current pallette by the value of the bits (C1, C0, where C1 is the higher order bit). See the description of Bit 4 in the color register programming for a definition of the pallettes. The black and white mode is similar to color, except that the color burst is disabled.

640 x 200 Black and White Graphics

This mode is similar to 320 x 200 color graphics mode except that each bit represents 1 pixel on the screen and there are twice as many pixels per line. Therefore, a line is represented by 80 consecutive bytes in the buffer as in 320 x 200 mode. Black is encoded as zero and white as one. The upper left corner of the screen is B7 of the first byte of the buffer.

6. Character Generation in Graphics Modes

A table of the first 128 characters similar to the alpha

mode character generator is in the ROM. Each character is defined by 8 consecutive bytes, representing the LIT pixels for each row of the character from top to bottom. The most significant bit represents the left-hand dot of a row. When the data is transfered to the video memory to be displayed, it must be split into even and odd row data and written to the appropriate buffers, any other characters which are to be displayed (including those corresponding to Codes 128-255 in alpha mode) must be defined by the user. These patterns will be accessed as codes 128-255 by the ROM's INT 10H graphics character routines if the user points to the table with interrupt vector 1FH.

7. Standard Initialization for 6845 CRT Controller Circuit
The CRT controller is intialized for a given display mode by outputting a string of 16 bytes to its register 0 – 15 respectively. For each byte to be output, the register number must first be output to the address register (port eD4), followed by the data byte to the desired register (port 3D5).

   The strings used by the ROM for the 40 x 25 alpha, 80 x 25 alpha and graphics modes are given in the description of INT 10H.

6-3 I/O MAP, COLOR GRAPHICS ADAPTOR

prot (Hex) Type Function Bit Definitions

Motorola 6845 CRT Controller Circuit:

3D4	Output	Address Register
3D5	I/O	18 Registers

Miscellaneous Ports:

3D8	Output Mode Register	B0=80 x 25 Mode B1=320 x 200 Graphics B2=B & W Mode B3=Enable Video B4=640 x 200 B & W B5=Blinking B6=Not Used B7=Not Used
3D9	Output Color Register	B0=Blue B1=Green B2=Red B3=Intensify R.G.B. B4=Alt. Back Colors B5=320 x 200 Color Set B6=Not Used B7=Not Used
3DA	Input Status Register	B0=Video Sync B1=Light Pen Trig'd B2=Pen Switch off B3=Alpha Data B4=Not Used B5=Not Used B6=Not Used B7=Not Used

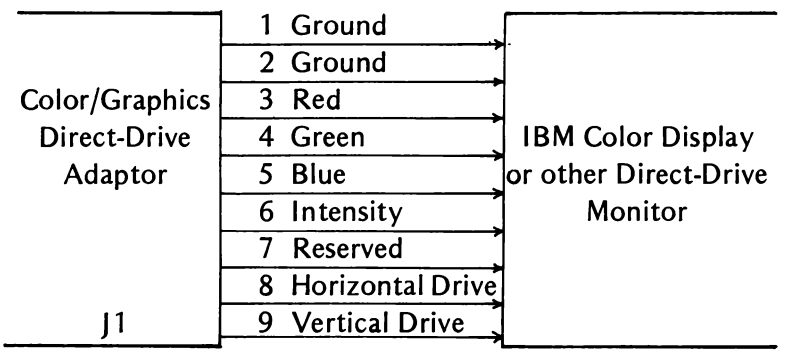
3DB Output Clear Light Pen Latch

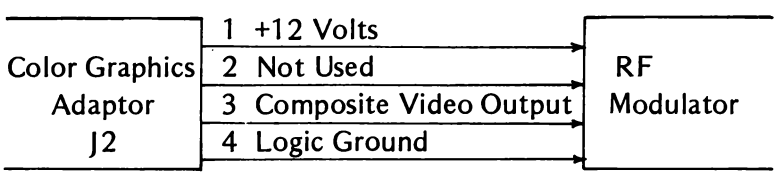
3DC Output Set Light Pen Latch

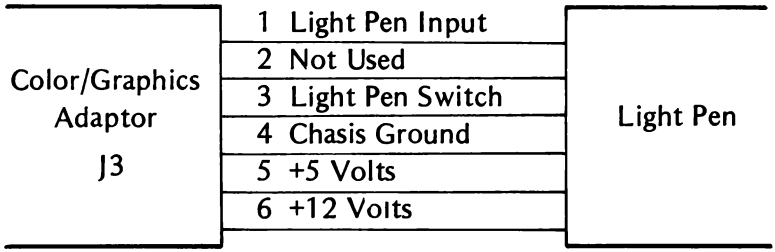
Memory Map of Color Graphics Adaptor:

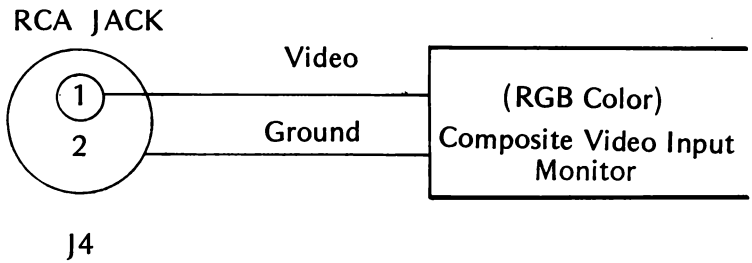
Address Range (Hex)	Memory Type	Function
B8000-BBFFF	RAM	Video Display Buffer

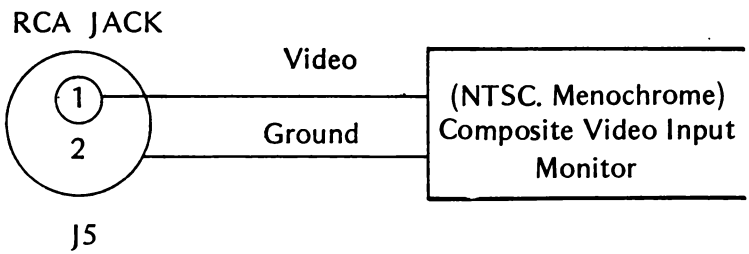
Connector Specifications

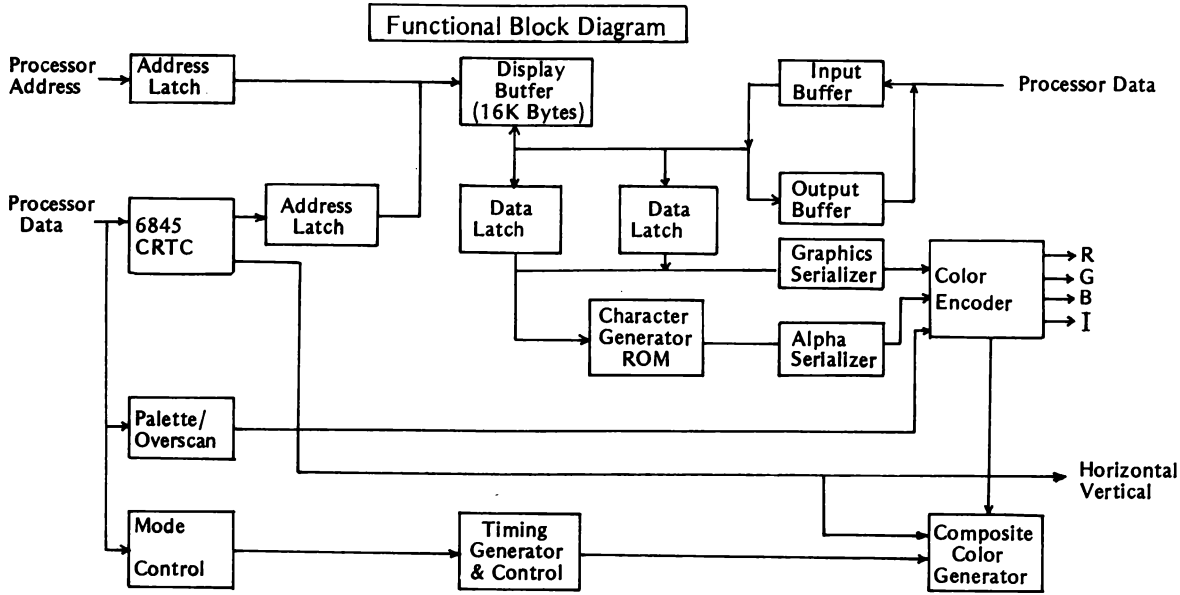


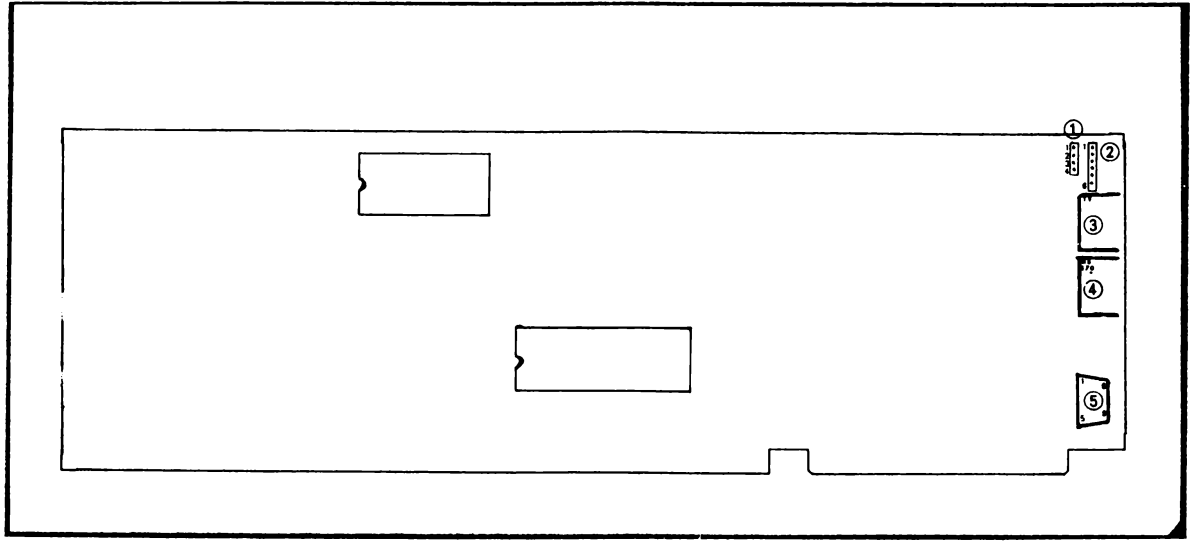



Color/Graphics Adaptor
J3
1 Light Pen Input
2 Not Used
3 Light Pen Switch
4 Chasis Ground
5 +5 Volts
6 +12 Volts
Light Pen


RCA JACK
1
2
Video
Ground
(RGB Color)
Composite Video Input
Monitor
J4


RCA JACK
1
2
Video
Ground
(NTSC. Menochrome)
Composite Video Input
Monitor
J5


Functional Block Diagram
Processor Address
Address Latch
Display Butfer (16K Bytes)
Input Buffer
Processor Data
Processor Data
6845 CRTC
Address Latch
Data Latch
Data Latch
Output Buffer
Graphics Serializer
Color Encoder
R
G
B
I
Character Generator ROM
Alpha Serializer
Palette/ Overscan
Horizontal
Vertical
Mode Control
Timing Generator & Control
Composite Color Generator



6-12

At the upper right corner : component side

1. J2 = Composite video port for driving a user supplied RF modulator
2. J3 = Light pen interface
3. J4 = Color composite video port
4. J5 = B/W Standard composite video port
5. J6 = Direct drive video port.

CHAPTER 7 MONOCHROME/GRAPHIC/PRINTER CARD

7-1 GENERAL DESCRIPTION

THe MONOCHROME GRAPHICS BOARD has both a video gràphics function and a printing function that are designed to work with the IBM monochrome display (18.7 KHz H. SYNC) and the IBM dot MATRIX printer.

This board has two modes for the display:
1. TEXT MODE: 80 column by 25 line addressable.
2. GRAPHICS MODE: 720 column by 348 addressable dots.

In TEXT mode, each type in the buffer controls a character of 9 by 14 dots. The pattern of these characters are predefined and the user specifies an 8 bit code to call them to the screen. There is a byte to control the attributes of each character being displayed.

The attributes can be:
NORMAL: a white character on a black screen.
REVERSE: a black character on a white background.
HIGHLIGHT: brighter color.
BLINK: blinking at a rate of 0.5 second.
UNDERLINE: underline the character being displayed.

IN TEXT mode, the display buffer provides two independent page of 80 columns by 25 lines each, only one of which is displayed at a time.

In GRAPHICS mode, the bits in the buffer, control the actual

dots on the screen. Screen patterns are formed by writing l's and '0's to the buffer. The buffer is organized as two complete screens that can be alternately displayed. This feature makes it possible to-compose one pattern while displaying another, which is particularly useful for animation.

The printing function is implemented using strictly input and output ports with a parallel interface printer. Handshake signals are provided from the I/O ports to allow the use of printers that operate at different speeds.

The MONOCHROME GRAPHICS BOARD is directly compatible with the I.B.M. Monochrome card in TEXT mode and PRINTER port with an enhanced function of 720 x 348 graphics on a monochrome monitor.

A HBASIC program is provided to update the BASICA program for graphics functions. Section III will describe the HBASIC in detail. Section II describes the Hardware Technical Information.

7-2 HARDWARE TECHNICAL INFORMATION

A) DISPLAY BUFFER

In TEXT mode, each 16 bit word represents one character with the character code in the even byte and the attribute code in the odd byte. Each line of text (80 characters) uses up to 160 consecutive bytes.

There are two text pages, with page 0 starting at &HB0000 to &HB0FFF and page 1 at &HB8000 to &HB8FFF. By writing

a '0' to bit 7 of the display mode control port (&H3B8) will select page 0 for display and writing a '1' will select page 1.

The attribute is controlled by the attribute data byte as follows:

DATA BIT:	7	6	5	4	3	2	1	0	ATTRIBUTE
	B	0	0	0	I	0	0	0	BLANK
	B	0	0	0	I	0	0	1	UNDERLINE
	B	0	0	0	I	1	1	1	NORMAL VIDEO
	B	1	1	1	I	0	0	0	REVERSE VIDEO

WHERE: 1 = 0 for normal body intensity
= 1 for high body intensity
If BLINK ENABLE = 0
B = 0 for normal background intensity
= 1 for high background intensity
If BLINK ENABLE = 1
B = 0 for not blinking
= 1 for blinking

In graphics mode, each horizontal line of 720 dots is stored in the buffer as 90 consecutive bytes, with bit 7 as the leftmost bit on the screen. The buffer store two full screens by putting page 0 at B0000 to B7FFF and page 1 at B8000 to BFFFF. Each page is divided into 4 fields of 8K consecutive bytes. The display takes one line from field 0, and then goes to fields 1,2 and 3. This sequence continues for the entire screen so the adjacent lines from the same field are displayed 4 lines apart on the screen.

B) MEMORY MAP

DISPLAY BUFFER : &HB0000 – &HBFFFF

TEXT MODE:

Page 0 at B0000 to B0FFF
Page 1 at B8000 to B8FFF

GRAPHICS MODE:

Page 0 at B0000 to B7FFF
Page 1 at B8000 to BFFFF

ADDRESS CALCULATION

DEF. V = vertical column (0 to 719);
X = integer (V/8)
H = horizontal line (0 to 347);
Y = integer (H/4)

BYTE ADDRESS LINES

F E D C B A 9 8 7 6 5 4 3 2 1 0

! ! ! !

PAGE (H mod 4) (90 * Y) + X
no.

C) I/O MAP

I/O PARTS: 3B4 6845 INDEX REGISTER
3B5 6834 DATA REGISTER
3B8 DISPLAY MODE CONTROL PORT
3BA DISPLAY STATUS PORT
3BC PRINTER DATA PORT
3BD PRINTER STATUS PORT
3BE PRINTER CONTROL PORT

1) 6845 REGISTER TABLE (3B5 WITH REGISTER # WRITTEN TO 3B4)

REG.#	VIDEO RPARAMETER	TEXT VALUE	GRAPHICS VALUE	UNIT
R0	HORIZONTAL TOTAL	97	53	CHAR
R1	HORIZONTAL DISPLAY	80	45	CHAR
R2	HSYNC POSITION	82	46	CHAR
R3	HSYNC WIDTH	15	8	CHAR
R4	VERTICAL TOTAL	25	91	ROWS
R5	VERTICAL ADJUST	6	2	LINES
R6	VERTICAL DISPLAYED	25	87	CHAR
R7	VSYNC POSITON	25	87	ROWS
R8	INTERLACE MODE	2	2	ROWS
R9	MAX. SCAN LINE ADDR	13	3	————
R10	HORIZOTAL DISPLAY	12	0	LINES
R11	HORIZONTAL DISPLAY	0	0	LINES
R12	SCREEN START ADDR (H)	0	0	————
R13	SCREEN START ADDR (L)	0	0	————
R14	CURSOR ADDR (H)	0	0	————
R15	CURSOR ADDR (L)	0	0	————

NOTE: For more technical information about the 6845 CRT controller chip, plaese refer to the 6845 manual.

2) DISPLAY MODE CONTROL PORT

BIT 1 : GRAPHIC ENABLE

When cleared, the video information comes from the character generator and the attribute decoding logic. The character codes are fetched from even

bytes in the display buffer. The corresponding attribute codes are fetched from the next odd byte. When this bit is set, video information comes from bits in the display buffer itself.

BIT 3: VIDEO ENABLE
This bit gives the video information onto the screen.

BIT 5: BLINK ENABLE
This bit is used only when the graphics bit is cleared. It causes a character to blink if its attribute code has bit 7 set.

BIT 7: PAGE SELECT
This bit selects the display page in both text and graphics modes.

3) DISPLAY STATUS PORT

BIT 0: HORIZONTAL SYNC
This bit is set during the horizontal retrace period.

BIT 3: VIDEO OUTPUT
This bit echoes the video signal being sent to the screen.

BIT 7: —VERTICAL SYNC
This bit is cleared during the vertical retrace period.

4) PRINTER CONTROL PORT

BIT 0: STOBE–

A "O" in this bit cause the printer to read the data. The period must be 0.5 microseconds.

BIT 1: AUTOFEED +

Setting this bit cause the printer to line feed after printing.

BIT 2: INIT–

A "O" in this bit resets the printer.

BIT 3: SELECT+

Setting this bit selects the printer and enable subsequent data transfers.

BIT 4: IRQ7 ENALBE+

Setting this bit causes a level 7 interrup, to be generated even time the printer acknowledges a transfer of data.

5) PRINTER STATUS PORT

BIT 3: ERROR–

This bit is set if the printer shows no fault in operation.

BIT 4: SELECT STATUS+

This bit is set when the printer is in the selected state and ready to accept data.

BIT 5: PAPER OUT+

This bit is set when the printer is out of paper.

BIT 6: ACK–

This bit is cleared for about 5 microseconds when the printer is ready to accept another data transfer.

BIT 7: BUSY–

This bit is set when the printer is ready to accept data. It will be cleared during data entries, printing operation and orror states. The printer will also clear this bit when it is off-line.

7-3 SOFTWARE TECHNICAL INFORMATION

A) HBASIC

The purpose of HBASIC, is to allow you to use BASICA's graphics system with the MONOCHROME GRAPHICS BOARD. The HBACIC1 is use with DOS 1.10 only and the HBASIC is use with DOS 2.00 only. We will refer both HBASIC1 and HBASIC as BASICA's

Before you use HBASIC, you must load the BASICA to the diskette first, we suggest that you protect your BASIC diskette and make a copy of it.

The HBASIC contains these files as follows:

HBASIC1. EXE: for DOS 1.10 only
HBASIC. EXE: for DOS 2.00 only
MGB-DEMO.BAS: a DEMO file for TEXT and GRAPHICS

MGB-INFO.DAT: a INFORMZTION file for your reference

To use the HBASIC, type

HBASIC1 (ENTER) (for DOS 1.10)
HBASIC (ENTER) (for DOS 2.00)

The HBASIC will call the BASICA automatically and modify it for the graphics statements. You should now see the BASIC copyright statement. You should now see the BASIC copyright statement and the BASIC prompt O.K. We suggest that you run the MGB-DEMO. BAS to verify the HBASIC if it's operate properly.

When using HBASIC, observe the following features:

1) HBASIC will not accept the following statements: COLOR; SCREEN 0; SCREEN1; WIDTH 40

2) HBASIC use a character size of 9 dots wide by 14 dots tall. BASICA uses a character size of 8 x 8 dots. Be aware of this difference when converting screen positions from rows and columns to x,y coordinates.

3) When you embed color specifications in a BASIC statement, they will be interpretted modulo 2. This means that if your color specification is 2 in a CIRCLE statement, then the circle will be drawn black.

4) The range of values of the screen coordinated are 0-709 horizontal from left to right, and 0-347 vertical from top to bottom.

5) The monochrome display has an aspect ratio of 2/3. Embed, this is a CIRCLE statement to get a round circle. Also, to draw a square, make the vertical lines 2/3s as long as the horizontal lines.

6) HBASIC interprets slower than BASICA, so timing loops will take longer to run.

7) To edit BASIC programs written for the IBM color card:

   a) Change SCREEN 0 and SCREEN 1 statements to SCREEN 2
   b) Eliminate the COLOR statements
   c) Change all WIDTH 40 statements to WIDTH 80
   d) Change the aspect ratios to 2/3s
   e) Change the x/y coordinated to compensate for the larger monochrome screen

8) When using HBASIC, you cannot display the second page of information. This is because BASICA does not allow you to. If you insist on seeing the second page by jsing the OUT command, you can damage the monitor.

   DON'T USE THE "OUT" COMMAND TO THE DISPLAY MODE CONTROL PORT.

B) HOW TO USE IBM'S DIAGNOSTICS DISKETTE

   If you try to run the IBM diagnostic diskette with "MONOCHROME GRAPHICS BOARD," in your system, your screen will display jumbled patterns and you may damage your monitor. Follow these instructions carefully to make a working copy of the diagnostic program.

1) Make a copy of this diagnostics program, by formating a blank diskette and using the DISKCOPY or COPY command described in the DOS manual.

2) Boot DOS and wait for A>. Put your diagnostic copy in Drive B.

3) Type DEBUG B: DIAGS. COM ENTER.

4) After a minus sign and the cursor appear, type S 100 FFFF BA B8 03 B0 FF ENTER

   The system will answer with MMMM:NNNN. (MMMM and NNNN represent hax numbers that will vary among versions of diagnostic disks)

5) Type E NNNN ENTER

6) Hit the space bar after each of the following: BA.; B8.; 03.; and B0. After FF.; type 7D ENTER

7) After the minus sign and the cursor, type W ENTER

8) After the minus sign and cursor, type Q ENTER The A> should reappear.

9) To run the diagnostic program, put your diagnostic copy in Drive A. Hold down the Alt, Ctrl and Del keys simultaneously to reset the system and start the diagnostics program.

10) Consult your IBM Guide to Operations to step through the diagnostics program. When "SYSTEM 400" or an

error message appear, the system checkout is complete, as far as you can go without a color card in the system. If you wish to complete the test, have your dealer insert one.

If you have followed these steps correctly, that is what you will seen on the display:

```
Current date is Tue 1-01-1980
Enter new data: 3-4-83
Current time is 0:00:08.84
Enter new time: 12:00:00

The IBM Personal Computer DOS
Version 1.10 (C) Copyright IBM Corp 1981, 1982

A>DEBUG B:DIAGS.COM
-S 100 FFFF BA B8 03 B0 FF
MMMM:NNNN
-E NNNN
MMMM:NNNN BA. B8. 03. B0. FF. 7D.
-W
Writing 40BF bytes
-Q

A>
```

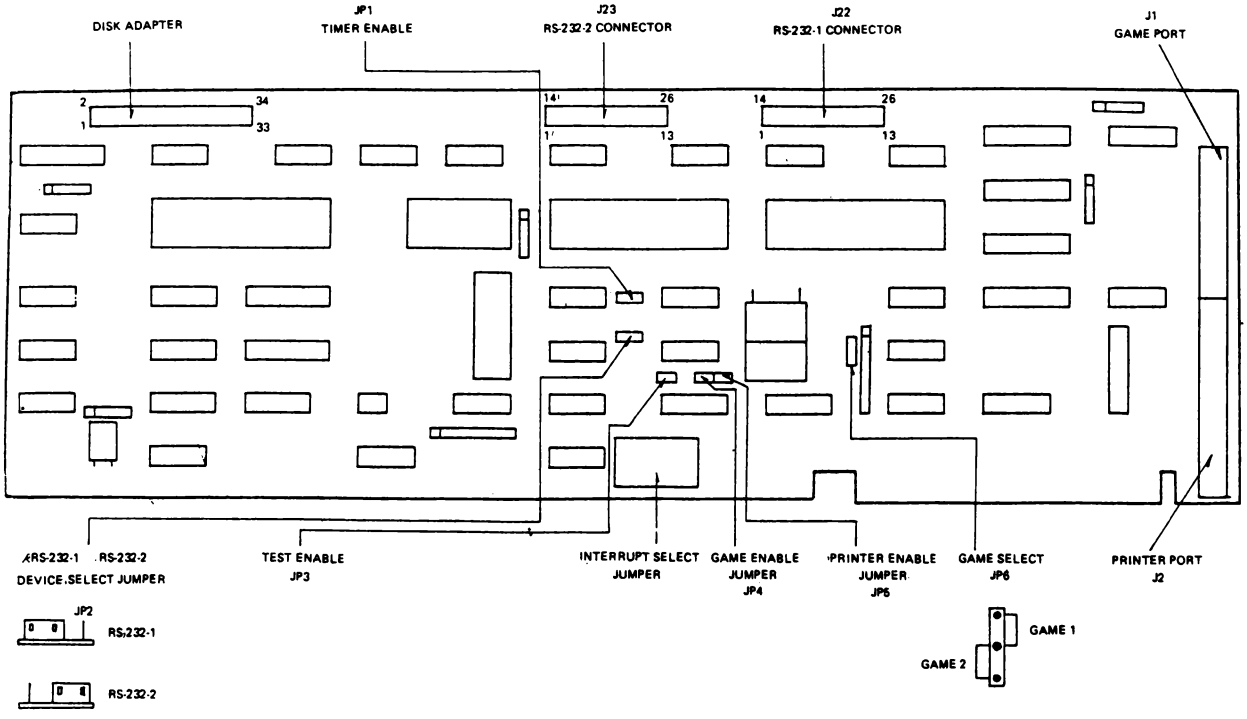
CHAPTER 8 MULTI-I/O CARD.

INTRODUCTION

MULTI I/O card provides your system 5 majors function:

1. FLOPPY DISK ADAPTER: two DS/DD floppy disk can be drive.
2. PARALLEL PRINTER PORT.
3. 2 SERIAL I/O PORT (RS-232-1, RS-232-2).
4. BATTERY BACKUP CLOCK/CALENDAR.
5. GAME ADAPTER.

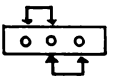
Consider the following figure of multi I/O card:



A BRIEF DESCRIPTION ABOUT MULTI I/O CARD

- DISK ADAPTER: Allow you to plug flag cable driver two FDD.
- RS-232-2 (J23): Allow you connect standard RS-232 interface to transmit and receive data in serial mode.
- RS-232-1 (J22): Allow you connect standard RS-232 interface.
- JP1 :TIMER SELECT JUMPER

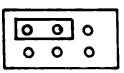
TIMER2(HEX 240H)



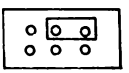
TIMER 1(HEX 340H)

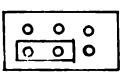
-JP2:COMI OR COM2 SELECTING JUMPER

RS232-2(J23)is COM2

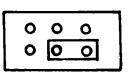


RS232-1(J22)is COM2





RS232-2(J23)is COMI



RS232-1(J22)is COMI

- JP3: LPT1 OR LPT2 SELECTING JUMPER

PRTNTER IS LPT1

PRINTER IS LPT2

- JP4 GAME ENABLE JUMPER.
- JP5 PRINTER ENABLE JUMPER.
- JP6 GAME ADAPTER IS GAME PORT1 OR 2.
- INTERRUPT LEVEL SELECTIVE AREA.
- PRINTER PORT: Allows you to connect the parallel printer.
- GAME PORT: Allows joy-stick connect there.

HOW TO USE THE MULTI I/O CARD

1. FLOPPY DISK

Use flag disk cable please check pin 1 make correct to connect disk port golden pin. Cable other hand have two 34 pin female disk connector distance cable longer connector is DRIVER A.

2. PARALLEL PRINTER INTERFACE

The parallel printer interface is designed to connect printer. Parallei printer supports the graphics function by driver software. User device jumper to enable/disable enable or disable your printer.

– PIN DEFINE:

1 –STROBE	10 –ACK
2 DATA 0	11 +BUSY
3 DATA 1	12 +PE
4 DATA 2	13 +SELECT
5 DATA 3	14 –AUTO FD XT
6 DATA 4	15 –ERROR
7 DATA 5	16 –INIT
8 DATA 6	17 –SELECT INPUT
9 DATA 7	18–26 GROUND

3. SERIAL INTERFACE RS-232 CONNECTOR

The serial interface is standard EIA RS-232 interface that is fully programmable and support IBM asychronous. The BAUD rate (bit/sec) can be set from 50 to 9600.

- There are 2 serial port (RS-232-1 and RS-232-2), normal the card provides you all component for RS-232-1; but RS-232-2 is optional. You must provide all support ICs by yourself (8250 etc.)

- Use DEVICE SELECT JUMPER to define either RS-232-1 or RS-232-2 as COM 1 or COM 2. But you can't define RS-232-1 and RS-232-2 at the same device. COM 1 is assigned to port 3F8H, COM2 is assign to port 2F8H.

- Use INTERRUPT SELECT JUMPER to assign the interrupt level to COM function.

- Normally, COM 1, data terminal equipment mode, level 4 interrupt is selected.

- RS-232 PIN DEFINE:

PIN 2	TRANSMIT DATA
PIN 3	RECEIVE DATA
PIN 4	REQUEST TO SEND
PIN 5	CLEAR TO SEND
PIN 6	DATA SET READY
PIN 7	GROUND
PIN 20	DATA TERMINAL READY
PIN 22	RING INDICAT

4. BATTERY BACKUP CLOCK/CALENDAR

The CLOCK/CALENDAR is battery powered, when PC is turned OFF, the battery supports power to CLOCK/CALENDAR; when PC is turned ON, the battery is recharged.

The CLOCK/CALENDAR is used with the TIMER.COM program on the MS-DOS diskette to set the time and data. For detail, refer to TIMER USER MANUAL.

The DEVICE SELECT JUMPER allows you to select TMR 1 or TMR 2. TMR 1 is assigned to the port 340H; TMR 2 is assigned to the port 240H. Normally, TMR 1 is set. INTERRUPT SELECT JUMPER allows you to assign interrupt level to the device.

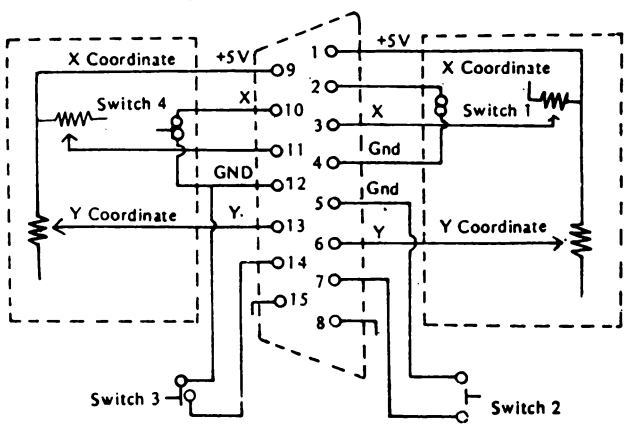
GAME CONTROL ADAPTER

The game adapter allows you to attach two JOY-STICK to PC, the paddles must have range of 0 to 100K ohms. Experience has show lot of variation even in IBM PC compatible JOY-STICK, so you should in JOY-STICK with a centering mechanism so that you adjust your JOY-STICK to the program.

GAME CONTROL ADAPTER PIN ASSIGNMENTS

The MULTI I/O card uses a 15 pin female "D" connector for the game control adapter.

15 PIN MALE "D" CONNECTOR



PC TIMER 1.3 USER GUIDE

PC TIMER 1.3 USER GUIDE

INTRODUCTION

Consider the hardware configuration of the multifunction card, you can see a battery powered CLOCK/CALENDAR. You may ask what is its function and how to use it? The answer can be found in this section. You can use the TIMER.COM program to operate it.

THE FUNCTION OF TIMER.COM PROGRAM

– Allows you to initialize the date and time in the CLOCK/CALENDAR device. A rechargeable battery provides the power to the CLOCK/CALENDAR still works and the time and date that you set in last time are still maintained.

– Allows you to set the date and time in the system.

– Reports you the current status of the CLOCK/CALENDAR.

GETTING START

There are 2 ways to start the timer program:

1) Type in TIMER command and option.

2) Create an AUTOEXEC.BAT file, this file will auto execute once you reboot your system.

   a) If you haven't an AUTOEXEC.BAT file on your diskette, create it; first type in

COPY CON: AUTOEXEC.BAT

Press ENTER key

Then type in

TIMER/S [Ctr] + Z] (or key in the F6 function key)

Press ENTER key

The A > prompt redisplays again and you have created an AUTOEXEC.BAT file.

The screen's displaying:

```
A>COPY CON: AUTOEXEC.BAT
   TIMER/S^Z
            1 File(s) Copied
A>
```

In the above commands, the first command line tells DOS to copy the information entered on the keyboard into the AUTOEXEC. BAT file. The second command line enter the TIMER/S program so that once you run the AUTOEXEC.BAT file the TIMER/S will execute automatically. The [Ctrl + Z] or F6 means that you can press the Ctrl key and Z key together or you only press F6 key. This causes the ststem that additional keyboard information is not go into the file and causes the information to be written into the file.

Once you have created the AUTOEXEC.BAT file, when you reset your system, the TIMER/S in the AUTOEXEC.BAT file will transfer the time in the CLOCK/CALENDAR into the system. The screen will display:

```
A > TIMER/S

** PC TIMER 1.3 **
Current time is XX:XX:XX:XX
Current date is XXX XX – XX – XX
```

b) If the AUTOEXEC.BAT file already exists on your diskette, you will need to add one line to the file. You must have the line editor EDLIN program on your diskette.

Type in

EDLIN AUTOEXEC.BAT

Press ENTER key

Type in

li

Press ENTER key

Type in

TIMER/S

Press ENTER key

Type in

[Ctrl] C
E

Press ENTER key

The A > prompt redisplays again. You have created an AUTOEXEC.BAT file with the TIMER/S program in it.

The screen displays as follow:

```
A>EDLIN AUTOEXEC.BAT
*li
  i : *TIMER/S
  2: *  C
*E

A>
```

TIMER'S COMMAND

TIMER/? Help menu, provides you a listing of TIMER's command. The TIMER HELP MUNU is displayed as follow:

```
** PC TIMER 1.3 **
Timer Help Menu:
TIMER           Read current time & date.
TIMER/I         Initial setting current time & date to
                system clock.
TIMER/S         Set current time & date to system clock.
TIMER/?         Help menu.
TIMER FORMAT    HOUR: MINUTE: SECOND (Every item
                have two digits)
DATE FORMAT     MONTH – DAY – YEAR (Every item
                have two digits)
```

Let us discuss the commands shown in the HELP menu

TIMER Reads current time and date and displays the date and time. The screen displays as follow:

```
** PC TIMER 1.3 **
Current time is XX:XX:XX:XX
Current date is XXX XX – XX – XX
```

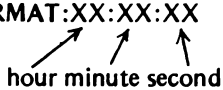
TIMER/I Initializes the CLOCK/CALENDAR device on the MULTI I/O card. It will first display the time and date currently exist and ask you to enter the new time and date. After you have entered the time and date, the program will check whether their formats are correct. If they are correct, the TIMER program set them onto the CLOCK/CALENDAR device, otherwise an error message is displayed and you have to try again. If you don't want make any change, just press the ENTER key. The screen's displaying are shown in the following figures:

```
** PC TIMER 1.3 **
Current time is XX:XX:XX:XX:
Enter new time:
```

After entered the date correctly and press ENTER key the screen display:

```
** PC TIMER 1.3 **
Current time is XX:XX:XX:XX
Current date is XXX XX – XX – XX
```

TIME FORMAT:XX:XX:XX



NOTE: The TIMER program only accepts 8 characters:

2 digits for each item.
2 characters to seperate the digits, you can use any characters to separate the items. But the standard form is use"

HOUR range from 0 – 23
MINUTE range from 0 – 59
SECOND range from 0 – 59

DATE FORMAT: MONTH – DATE – YEAR

MONTH range from 1 – 12
DATE range from 1 – 31
YEAR range from 0 – 99 (When you type in 0 – 79, the program considers it as year 2000 – 2079; when you type in 80 – 99, the program considers it as 1980 – 1999.)

NOTE: Don't use alphabet.

The TIMER program only accepts 8 characters:
6 digits (2 digits for each item).
2 characters that separate each item.

If you had entered the invalid format of time or date the screen will display the following message.

```
Invalid time
Enter new time:

Invalid date
Enter new date:
```

You have to try again or just press the ENTER key to skip it. If you just press the ENTER key to skip it,the original time and date remain unchange.

TIMER/S This command displays the time and date and sets the system time and date. It is convenient to insert it into the AUTOEXEC.BAT file to automatically display and set the system time when the system is booted or reset.

CHAPTER 9 POWER SUPPLY

The system power supply is located at the right rear of the system unit. It is designed to be an integral part of the system-unit chassis. Its housing provides support for the rear panel, and its fan furnishes cooling for the whole system.

It supplies the power and reset signal necessary for the operation of the system board, installable options, and the keyboard. It also provides a switched AC socket for the display monitor and 4 separate connectors for power to the 5¼ inch diskette drives or 10M Fixed Drive.

150W POWER SUPPLY

The expansion unit DC power supply is a 130-watt, 4 voltage level switching regulator. It is integrated into the expansion unit and supplies power for the expansion unit, and its options. The power supply provides 15A of +5 Vdc, plus or minus 5%, 4.2A of +12 Vdc, plus or minus 5%, 300mA of −5 Vdc, plus or minus 10%, and 250mA of −12 Vdc, plus or minus 10%. All power levels are regulated with over-voltage and over-current protection. The input is 120 Vac and fused. If DC over-load or over-voltage condition exist, the supply automatically shuts down until the condition is corrected. The supply is designed for continuous operation at 135 watts.

The power supply was located at the right rear of the expansion unit. It supplies operating voltages to the expansion board, and provides two separate connections for power to the fixed disk drives.

Voltage (Vac at 50/60 Hz)			Frequency (Hz)	Current (Amps)
Nominal	Minimum	Maximum	+/— 3Hz	Maximum
120	104	127	50/60	4.1 at 90 Vac

Voltage (Vdc)	Current (Amps)		Regulation (Tolerance)	
Nominal	Minimum	Maximum	+%	—%
+ 5.0	2.3	15.0	5	4
— 5.0	0.0	0.3	10	8
+ 12.0	0.4	4.2	5	4
—12.0	0.0	0.25	10	9

Over-Voltage/Over-Current Protection

The system power supply exploys protection features which are described below.

Primary (input)

The following table describes the primary input voltage) protection for the system-unit power supply

W	Voltage (Nominal Vac)	Type Protection	Rating (Amps)
65W	120	Fuse	2
100W	120	Fuse	3.5
135W	120	Fuse	5

Secondary (Output)

On over-voltage, the power supply is designed to shut down all outputs, when either the +5 Vdc or the +12 Vdc output exceeds 200% of its maximum rated voltage. On over-current, the supply will turn off if any output exceeds 130% of its nominal value.

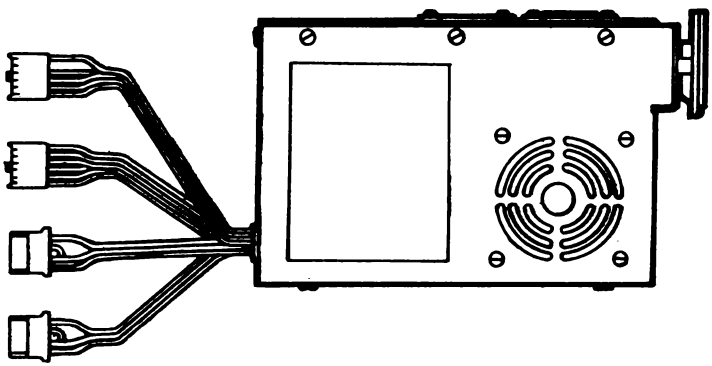
Power-Good Signal

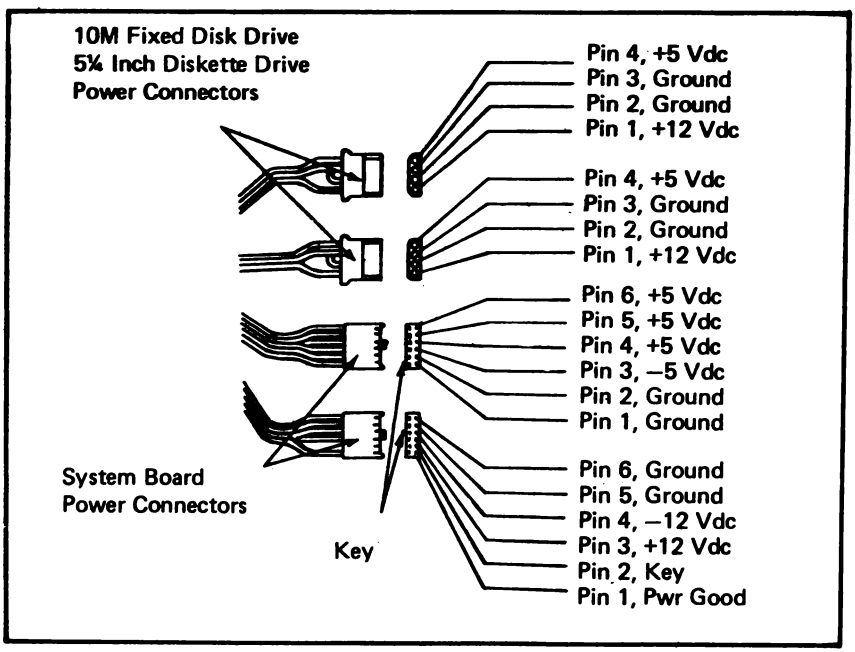
When the power supply is turned on, it generates a 5V TTL level power-good signal. The signal will go from low to high.

Vac Output

The power supply provides a filtered, AC output that is switched on and off with the main power switch. The maximum current available at this output is 0.75A. The recepticle provided at the rear of the power supply for this AC output is a nonstandard connector designed to be used only for the Monochrome Display.

150W POWER SUPPLY





SWITCHING POWER SUPPLY

A. ELECTRICAL

1.1 INPUT VOLTAGE	95Vac TO 135Vac; 190Vac TO 260Vac (USED SELECTABLE)
1.2 INPUT FREQUENCY RANGE	49Hz TO 61Hz
1.3 INPUT CURRENT MAXIMUM	2.6Amp
1.4 INRUSH CURRENT	COLD START 20Amps PEAK MAX.
1.5 EFFICIENCY	70% TYPICAL AT FULL LOAD 115V/230V IN
1.6 OUTPUT VOLTAGE ANd CURRENT	+5V AT 20.0 Amp MAX. −5V AT 0.3 Amp MAX. +12V AT 7.3 Amp MAX. −12V AT 0.3 Amp MAX.
1.7 OUTRUT TOTAL POWER	192W
1.8 OUTPUT VOLTAGE TOLERANCE	+5V FROM 0.5A TO 20A ±5% −5V FROM 0.2A TO 0.3A ±5% +12V FROM 0.5A TO 7.3A ±5% −12V FROM 0.2A TO 0.3A ±5%
1.9 RIPPLE/NOISE	+5V 50MV P-P −5V 50MV P-P +12V 100MV P-P −12V 100MV P-P
1.10 LINE REGULATION	±1% FOR ANY OUTPUT
1.11 SHORT CIRCUIT PROTECTION	WHEN ANY OUTPUT IS SHORT OR OVER LOAD, ALL OUTPUT CUT OFF AUTO-MATICALLY, THE POWER SUPPLY SHOULD BE RESTAR AFTER REMOVED SHORT-CIRCUIT CONDITION.
1.12 OVER VOLTAGE PROTECTION	+5V AT 6V PROTECTION +12V AT 14V PROTECTION
1.13 HOLD UP TIME	16ms TYPICAL
1.14 OPERATING TEMPERATURE	0°C – 50°C

B. MECHANICAL DIMENSION

LONG 240mm / WIDTh 150mm / HIGH 160mm / WEIGHT 3Kg

8 MHZ TURBO MAINBOARD

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2.2 I/O Channel Description 10-6
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on the System Board 10-11

1.0 INTRODUCTION

The difference between TURBO-640 and other PC/XT main boards is the TURBO-640 main board allows an increase at about 70% in speed of program execution. As the 8088-2 processor operates at a quicker speed at 8 mhz. In other PC/XT main board, The clock speed is only 4.77 MHZ.

The TURBO-640 consists of dual clock system, IN NOMAL MODE, The clock speed is only 4.77 MHZ cycle. IN TURBO MODE, The clock speed increases to 8 MHZ cycle.

NOTE: Please do not make use of RAM memory on interface card. Because its original design may be not compatible with 8 MHZ high speed CPU at access time

*Please use memory on mainboard and use 4164 & 41256 access time within 150 ns.

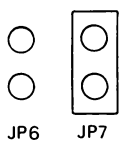
1.1 TO OBTAIN TURBO MODE AT 8MHz

The system board supports both software switch as well as hardware switch to allow transaction from Normal mode (4.77MHz) to Turbo mode (8MHz), vice versa.

A) SOFTWARE SWITCH:

*Software switch is available when using "ERSO/SCCI TURBO" BIOS only.

1) Jumper Setting:
For software switch, set Jumper JP7 on.



a) Turn on Turbo Mode:
Press and hold down the "CTRL" (CONTROL) and "ALT" (ALTERNATE) keys and then press the "–" (MINUS) key then the cusor on screen display will appear as a 'box'. Now, you are ready to use Turbo mode

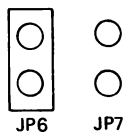
b) Return to Normal Mode:

* ERSO/SCCI Bios is registered copyright under ERSO
* ERSO: short form for "Electronics Research & Service Organization.

Press and hold down "CTRL" (CONTROL) and "ALT" (ALTERNATE) keys and then press the "—" (MINUS) key to come back to Normal Mode at 4.77MHz. You will see on screen display that the cursor shows up as a "—" (DASH)

B) HARDWARE SWITCH:

1) Jumper Setting:
Set Jumper JP6 on



a) **Push Turbo Switch into "ON" position to turn to Turbo Mode at 8 MHz.**

b) Return to Normal Mode:
Push the TURBO switch into "OFF" position to come back to Normal mode at 4.77 MHz.

ps. The push buttom leads to JP5 on mainboard
The push buttom at "ON" position means shorted circuit on the 2 pins of JP5. When at "OFF" position, the circuit is open.

Note: TURBO-640 board can run Lotus 1-2-3, CP/M 86, DBASE III and many other famous IBM package programs. Please note to use normal mode (4.77MHz) when running COPY WRITE.

1.2 Connectors

The system board has the following connectors:

- Speaker connector (P4)
- Two power-supply connectors (P1) and (P2)
- Keyboard connector (P5)
- Power LED and TURBO LED connector (J9)
- Turbo control connector (J5, J6, J7)
- Keylock connector (J8)
- 256K/512K/640K memory select (JP3, JP4)

The speaker connector is a 4-pin, keyed, 90 degree. The pin assignments follow.

Pin	Function
1	Data out
2	+5 Vdc
3	Ground
4	+5 Vdc

connect pin 1 & pin 2 to speaker, or pin 1 & pin 4 to speaker

Speaker Connector(P4)

The pin assignments for power-supply connectors, P1 and P2 are as follows:

Pin	Assignments	Connector
1	Power good	
2	Not used	
3	+12 Vdc	P1
4	−12 Vdc	
5	Ground	
6	Ground	
1	Ground	
2	Ground	
3	−5 Vdc	P2
4	+5 Vdc	
5	+5 Vdc	
6	+5 Vdc	

Power Supply connectors

The keyboard connector is a 5-pin, 90-degree Printed Circuit Board (PCB) mounting, DIN connector. The pin assignments are as follows:

Pin	Assignments
1	Keyboard clock
2	Keyboard data
3	Keyboard reset
4	Ground
5	+5 Vdc

Keyboard Connector (P5)

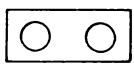
The power LED and LED connector is a 4-pin Berg strip. Its pin assignments follow:

Pin	Assignments
1	Turbo LED (N)
2	Tubo LED (P)
3	LED power (P)
4	Ground (N)

pin 1 & pin 2 connector to turbo LED pin 3 & pin 4 to power on LED.

Power LED and Keylock Connector (J9)

The keylock connector is a 2-pin, keyed, Berg strip. The pin assignments follow:



JP8

Keyboard locked, JP8 is open
Keyboard unlocked, JP8 is shortted

2.0 INSTRUCTION

The TURBO-640 consists of five functional areas: the processor subsystem and its support elements: The Read-Only Memory (ROM) subsystem, the Read/Write (R/W) Memory subsystem, integrated I/O adapters, and the I/O channel. All are discussed in this section.

The heart of the TURBO-640 board is the Intel 8088-2 microprocessor. This processor is an 8-bit external bus version of Intel's 16-bit 8086 processor, and it's softwares are compatible with the 8086. Thus, the 8088-2 supports 16-bit operations, including multiply and divide it also operates in a maximum mode, so a coprocessor can be added as a feature.

The processor is supported by a set of high-function devices providing four channels of 20-bit Direct-Memory Access (DMA), three 16-bit timer counter channels, and eight prioritized interrupt levels.

Three of the four DMA channels are available on the I/O bus and support high speed data transfers between I/O devices and momory without processor intervention. The fourth DMA channel is programmed to refresh the system dynamic memory. This is done by programing a channel of the timer-counter device to periodically request dummy DMA transfer. This action creates a memory-read cycle, which is available to refresh dynamic storage, both on the system board and in the system expansion slots.

The three programmable timer/counters are used by the system as follows: Channel 0 is used as a general purpose timer, providing a constant time base for implementing a time-of-day clock; Channel 1 is used to time and request refresh cycles from the DMA channel; and Channel 2 is used to support the tone generation for the audio speaker.

Of the eight prioritized levels of interrupt, six are bussed to the system expansion slots for use by features cards. Two levels are used on the system board. Level 0, the highest priority, is attached to Channel 0 of the timer/ counter and provides a periodic interrupt for the time-of-day clock. Level 1 is attached to the keyboard adapter circuits and receives an interrupt for each scan code sent by the keyboard. The Non-Maskable Interrupt (NMI) of the 8088-2 is used to report memory parity errors.

The system board supports both ROM/EPROM and R/W memory. It has space for 64Kx8 of ROM or EPROM. This ROM contains the power-on self-test, I/O drivers, dot patterns for 128 characters in graphics mode.

The system board also has 64K of R/W memory. Memory greater than the system board has a maximum of all R/W memory is parity checked.

The system board contains the adapter circuits for attaching the serial interface from the keyboard. There circuits generate an interrupt on to the processor, when a complete scan code is received. The interface can request execution of a diagnostic test

in the keyboard.

2.1 I/O Channel

The I/O channel is an extension of the 8088-2 microprocessor bus. It is, however, demultiplexed, repowered, and enhanced by the addition of interrupts and Direct Memory Access (DMA) functions.

The I/O channel contains an 8 bit, bidirectional data bus, 20 address lines, 6 levels of interrupt, control lines for memory and I/O read or write, clock and timing lines, 3 channels of DMA control lines, memory refresh timing control lines, a channel check line, and power and ground for the adapters.

I/O devices are addressed using I/O mapped address space. The channel is designed so that 768 I/O device addressed are available to the I/O channel cards.

A channel check line exists for reporting error conditions to the processor. Activation this line results a Non-Maskable Interrupt (NMI) to the 8088-2 processor. Memory expansion options use this line to report parity errors.

2.2 I/O Channel Description

The following is a description of the PC/XT I/O Channel. All lines are TTL-compatible.

Singal I/O Description:

OSC, Oscillator:
High speed clock with a 70-ns period (14.31818 MHz). It has a 50% duty cycle.

CLK, System Clock:
It is divide-by-three of the oscillator and has a period of 210 ns (4.77 MHz). The clock has a 33% duty cycle.

RESET:
This line is used to reset or initialize system logic upon power-up or during a low line voltage outage. This signal is synchronized to the falling edge of clock and is active high.

AO-A19, Address Bits 0 to 19:
These lines are used to address memory and I/O devices within the system. The 20 address lines allow access of up to 1 megabyte of memory. A0 is the Least Significant Bit (LSB) and A19 is the Most Significant Bit (MSB). These lines are generated by either the processor or DMA controller. They are active high.

DO-D7,I/O Data Bits 0 to 7:
These lines provide data bus bits 0 to 7 for the processor, memory, and I/O devices. DO is the Least Significant Bit (LSB) and D7 is the Most Significant Bit (MSB). These lines are active high.

ALE, Address Latch Enable:
This line is provided by the 8288 Bus Controller and is used on the system board to latch valid addresses from the processor. It is available to the I/O channel as an indicator of a valid processor address (when used with AEN). Processor addresses are latched with the failing edge of ALE.

I/O CH CK, I/O Channel Check:
This line provides the processor with parity (error) information on memory or devices in the I/O channel. When this signal is active low, a parity error would indicated.

I/O CH RDY, I/O Channel Ready:
This line, normally high (ready), can be pulled low (not ready) by a memory or I/O device to lengthen I/O or memory cycles. It allows slower devices to attacheh to the I/O channel with a minimum of difficulty. Any slow device using this line should drive it low immediately upon detecting a valid address and a read or write command. This lines should never be held low, longer than 10 clock cycles. Machine cycles (I/O or memory) are extended by an integral number of CLK cycles (210 ns)

IR02-IR07, Interrupt Request 2 to 7:
These lines are used to signal the processor, that a I/O device requires attention. They are prioritized with IR02 as the highest priority and IRQ7 as the lowest. An Interrupt Reguest is generated by raising an IRQ line (low to high) and holding it high, until it was acknowledged by the processor (interrupt service routine).

IOR, I/O Read Command:
This command line instructs an I/O device to drive its data into the data bus. It may be driven by the processor or the DMA controller. This signal is active low.

LOW, I/O Write Command:
This command line instructs an I/O device, to read the data on the data bus. It may be driven by the processor or the DMA controller. This signal is active low.

MEMR, Memory Read Command:
This command line instructs the memory to drive its data into the data bus. It may be driven by the processor or the DMA controller. This signal is active low.

MEMW, Memory Write Command:
This command line instructs the memory to store the data present on the data bus. It may be driven by the processor or the DMA controller. This signal is active low.

DRQ1-DRQ3 , DMA Request 1 to 3:
These lines are asynchronous channel requests used by peripheral devices to gain DMA service. They are prioritized with DRQ3 being the lowest and DRQ1 being the highest. A request is generated by bringing a DRQ line to an active level (high). A DRQ line must be held high until the corresponding DACK line goes active.

DACK0—3—DMA Acknowledge 0 to 3:
These lines are DACK3 used to acknowledge DMA requests (DRQ1-DRQ3) and to refresh system dynamic memory (DACK0). They are active low.

AEN, Address Enable:
This line is used to degate the processor and other devices from the I/O channel to allow DMA transfers to take place. When this line is active (high), the DMA controller has control the address bus, data bus, read command lines (memory and I/O), and the write command lines (memory and I/O).

T/C, Terminal Count:
This line provides a pulse when the terminal count for any DMA channel is reached. This signal is active high.

3.0 THE SYSTEM BOARD SWITCH SETTING

The DIP Switch (SW1) located at U20 is used to set the system configuration and specify the amount of memory installed on the system board.

Position	Function
1	Normal operation off
2	Use for 8087-2 co-processor
3–4	Amount of memory on system board
5–6	Type of display adapter
7–8	Number of 5¼ inch diskette drives

Switch (SW1):
1 = OFF (NORMAL OPERATION)
2 = ON W/O 8087-2 co-processor
2 = OFF W/ 8087-2 co-processor

Memory Switch Settings:

3 = OFF	4 = ON	128K MEMORY INSTALLED
3 = ON	4 = OFF	192K MEMORY INSTALLED
3 = OFF	4 = OFF	256K MEMORY INSTALLED

Display Adapter Switch Settings:

5 = ON	6 = ON	NO DISPLAY ADAPTER
5 = OFF	6 = ON	COLOR/GRAPHICS (40X20 Mode)
5 = ON	6 = OFF	COLOR/GRAPHICS (80 X25 Mode)
5 = OFF	6 = OFF	MONOCHROME DISPLAY ADAPTER OR BOTH

Display Dirve Switch Setting:

7 = ON	8 = ON	1 DRIVE INSTALLED
7 = OFF	8 = ON	2 DRIVES INSTALLED
7 = ON	8 = OFF	3 DRIVES INSTALLED
7 = OFF	8 = OFF	4 DRIVES INSTALLED

4. HOW TO INSTALL MEMORY RAM CHIPS ON THE SYSTEM BOARD.

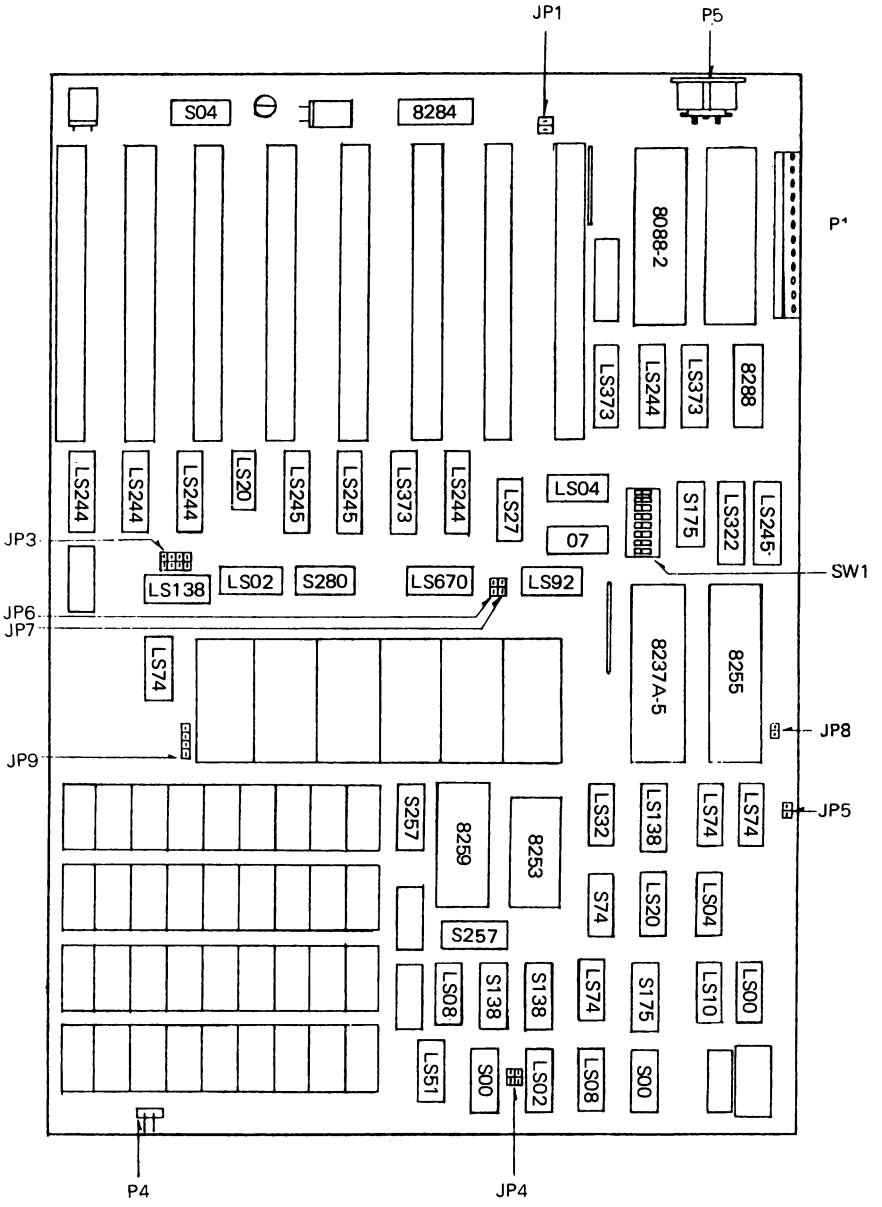
The turbo-640 mainboard provides 3 options of memory RAM installation on board: 256K RAM, 512K RAM and 640K RAM follow the instructions below for proper installation:

Option	RAM chips on Bank ϕ	RAM chips on Bank 1	RAM chips on Bank 2	RAM chips on Bank 3	* Jumper Location	
					JP 3	JP 4
256K RAM	4164x9	4164x9	4164x9	4164x9		
256K RAM	41256x9	No chips	No chips	No chips		
512K RAM	41256x9	41256x9	No chips	No chips		
640K RAM	41256x9	41256x9	4164x9	4164x9		

* Position of JP3, JP4

JP3 is located beneth the I/O slots, while JP4 at right-hand side of memory RAM block. (see figure next page)

About the direction of mainboard, the I/O slots area is always considered to be at the left-upper corner of mainboard.


JP1
P5
S04
8284
8088-2
P1
LS373
LS244
LS373
8288
LS244
LS244
LS244
LS20
LS245
LS245
LS373
LS244
LS27
LS04
07
S175
LS322
LS245
JP3
SW1
LS138
LS02
S280
LS670
LS92
JP6
JP7
8237A-5
8255
LS74
JP8
JP9
JP5
S257
8259
8253
LS32
LS138
LS74
LS74
S74
LS20
LS04
S257
LS08
S138
S138
LS74
S175
LS10
LS00
LS51
S00
LS02
LS08
S00
P4
JP4

10 MHZ TURBO MAINBOARD

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CHAPTER 1 THE SYSTEM BOARD

1-1 Introduction

The 10MHz — TURBO system board fits horizontally in the base of the system unit and is approximately 8½ x 12 inches. It is a double sided P.C.B., DC power and a signal from the power supply enter the board through two six-pin connectors. Other connectors on the board are for attaching the keyborad and speaker. Eight 62-pin card edge-sockets are also mounted on the board. The I/O channel is bussed across these eight I/O slots.

A "Dual-in-Line Package (DIP) switch (SWI) (one eight switch pack) is mounted on the board and can be read under program control. The DIP switch provides the system software with information about the installed options, how much storage the system board has, what type of the display adapter is installed, what operation modes are desired when power is switched on (color or black-and-white, 80- or 40-character lines), and the number of diskette drive attached.

The system board consists of five functional area: the processor subsystem and its support elements, the Read-Only Memory (ROM) subsystem, the Read/Write (R/W) Memory subsystem, integrated I/O adapters, and the I/O channel. All are desired in this section.

The heart of the 10MHZ Turbo system board is the INTEL 8088-1 or qualified 8088-2 microprocessor. This processor is an 8-bit external bus version of INTEL'S 16 bit 8086 processor, and it's softwarecompatible with the 8086. Thus, the 8088 supports 16 bit operations, including multiply and divide, and supports 20 bits addressing (1 megabyte of storage).

It also operates in a maximum mode, so a coprocessor can be added as a feature. The processor operates in two mode, which can be switched, called Normal mode and Turbo mode. When the processor operating at 4.77 MHZ called Normal mode, the frequency, which is derived from a 14.318 MHZ crystal, is devided by 3 for the processor clock, and by 4 to obtain the 3.58 MHZ color burts signal required for color television. When processor operating at 10 MHZ called Turbo mode, the frequency is derived from 30 MHZ.

– DMA –

Three of the four DMA channels are available on the I/O bus and support high speed data transfers between I/O devices and memory without processor intervention. The fourth DMA channel is programmed to refresh the system dynamic memory. This is done by programing a channel of the timer-counter device to periodically request a dummy DMA transfer. This action creates a memory-read cycle, which is available to refresh dynamic storage, both on the system board and in the system expansion slots. All DMA data transfers, except the refresh channel, take five processor clocks of 210 ns, or 1.05, μs if the processor ready line is not deactivated. Refresh DMA cycles take four clocks or 840 ns.

– TIMER –

The three programmable timer/counters are used by the system as follows: Channel o is used as a general purpose timer, providing a constant time base for implementing a time-of-day clock; Channel 1 is used to time and request refresh cycles from the DMA channel; and Channel 2 is used to support the tone generation for the audio speaker. Each channel has a minimum timing resolution of 1.05 μs.

– INTERRUPT –

Of the eight prioritized levels of interrupt, six are bussed to the system expansion slots for use by features cards. Two levels are used on the system board. Level 0, the highest priority, is attached to Channel 0 of the timer/counter and provides a periodic interrupt for the time-of-day clock. Level 1 is attached to the keyboard adapter circuits and receives an interrupt for each scan code sent by the keyboard. The Non-Maskable Interrupt (NMI) of the 8088 is used to report memory parity errors.

– MEMORY –

The system board supports both ROM/EPROM and R/W memory. it has space for 32k x 1 & 8k x 1 of ROM or EPROM. this ROM contains the power-on self-test, I/O drivers, dot patterns for 128 characters in graphics mode, and a diskette.

The system board also has from 256k to 640k of R/W memory. A minimum system would have 256k of memory.

– KEYBOARD –

The system board contains the adapter circuits for attaching the serial interface from the keyboard. These circuits generate an interrupt on to the processor, when a complete scan code is received. The interface can request execution of a diagnostic test in the keyboard.

The keyboard interface is a 5-pin DIN connector on the system board, that extends through the rear panel of the system unit.

– SPEAKER –

The system units has an 2¼ inch audio speaker. The speaker's control circuits and driver are on the system board. The speaker connects through a 2-wire interface that attaches to a 3-pin connector on the system board.

The speaker drive circuit could be capable of providing approximately ½ watt of power. The control circuits allow the speaker to be driven three different ways: 1) a direct program control register bit may be toggled, to generate a pulse train; 2) the output from Channel 2 of the timer counter, may be prog-

ramed to generate a wavefrom to the speaker; 3) the clock input to the timer counter, can be modulated with a program controlled I/O register bit. All three methods may be performed simultaneously.

1-2 Expansion I/O Channel

The I/O channel is an extension of the 8088 microprocessor bus. It is, however, demultiplexed, repowered, and enhanced by the addition of interrupts and Direct Memory Access (DMA) functions.

The I/O channel contains an 8 bit, bidirectional data bus, 20 address lines, 6 levels of interrupt, control lines for memory and I/O read or write, clock and timing lines, 3 channels of DMA control lines, memory refresh timing control lines, a channel check line, and power and ground for the adapters. Four voltage levels are provided for I/O card: +5Vdc, –5Vdc, +12 Vdc, and –12dc. These functions are provided in a 62-pin connector with 100-mil card tab spacing.

A "ready" lines is available on the I/O channel, to allow operation with slow I/O or memory devices. If the channel's ready line is not activated by an addressed device, all processor-generated memory read and write cycles takes four 210-ns clock or 840-ns/byte. All processor-generated I/O read and write cycles require five clocks for a cycle time of 1.05 μs/byte. Refresh cycles occur once every 72 clocks (approximately 15 μs) and require four clocks or approximately 7% ofthe bus bandwidth.

I/O devices are addressed using I/O mapped address space. The channel is designed so that 768 I/O device addressed are available to the I/O channel cards.

A channel check line exists for reporting error conditions to the processor Activating this line results in a Non-Maskable Interrupt (NMI) to the 8088 processor. Memory expansion options use this line to report parity errors.

The I/O channel is repowered, to provide sufficient drive, to power all eight (J1 through J8) expansion slots, assuming two Low-Power Schorttky (LS) loads per slot. The I/O adapters typically use only one load.

1-3 I/O Channel Descr iption

The following is a description of the PC/XT I/O Channel. All lines are TTL-compatible.

Singal I/O Description

OSC, Oscillator:

High; speed clock with a 70-ns period (14.31818 MHz). It has a 50% duty cycle.

CLK, System Clock:

It is divide-by-three of the oscillator and has a period of 210 ns (4.77 MHz). The clock has a 33% duty cycle.

RESET:

This line is used to reset or initialize system logic upon power-up or during a low line voltage outage. This signal is synchronized to the falling edge of clock and is active high.

AO-A19, Address Bits 0 to 19:

These lines are used to address memory and I/O devices within the system. The 20 address lines allow access of up to 1 megabyte of memory. AO is the Least Significant Bit (LSB) and A19 is the Most Significant Bit (MSB). These lines are generated by either the processor or DMA controller. They are active high.

DO-D7, I/O Data Bits 0 to 7:

These lines provide data bus bits 0 to 7 for the processor,

memory, and I/O devices. DO is the Least Significant Bit (LSB) and D7 is the Most Significant Bit (MSB). These lines are active high.

ALE, Address Latch Enable:

This line is provided by the 8288 Bus Controller and is used on the system board to latch valid addresses from the processor. It is available to the I/O channel as an indicator of a vilid processor address (when used with AEN). Processor addresses are latched with the failing edge of ALE.

I/O CH CK, I/O Channel Check:

This line provides the processor with parity (error) information on memory or devices in the I/O channel. When this signal is active low, a parity error would indicated.

I/O CH RDY, I/O Channel Ready:

This line, normally high (ready), can be pulled low (not ready; by a memory or I/O device to lengthen I/O or memory cycles. It allows slower devices to attach to the I/O channel with a minimum of difficulty. Any slow device using this line should drive it low immediately upon detecting a valid address and a read or write command. This lines should never be held low, longer than 10 clock cycles. Machine cycles (I/O or memory) are extended by an integral number of CLK cycles.

IRQ2-1RQ7, Interrupt Request 2 to 7:

These lines are used to signal the processor, that a I/O device requires attention. They are prioritized with IRQ2 as the highest priority and IRQ7 as the lowest. An Interrupt Request are gener-

ated by raising an IRQ line (low to high) and holding it high, until it was acknowledged by the processor (interrupt service routine).

IOR, I/O Read Command:

This command line instructs an I/O device to drive its data onto the data bus. It may be driven by the processor or the DMA controller. This signal is active low.

IOW, I/O Write Command:

This command line instructs an I/O device, to read the data on the data bus. It may be driven by the processor or the DMA controller. This signal is active low.

MEMR, Memory Read Command:

This command line instructs the memory to drive its data into the data bus. It may be driven by the processor or the DMA controller. This signal is active low.

MEMW, Memory Write Command:

This command line instructs the memory to store the data present on the data bus. It may be driven by the processor or the DMA controller. This signal is active low.

DRQ1-DRQ3, DMA Request 1 to 3:

These lines are asynchronous channel requests used by peripheral devices to gain DMA service. They are prioritized with DRQ3 being the lowest and DRQ1 being the highest. A request is generated by bringing a DRQ line to an active level (high). A DRQ line must be held high until the corresponding DACK

line goes active.

DACKO – 3 – DAM Acknowledge 0 to 3:

These lines are DACK3 used to acknowledge DMA requests (DRQ1-DRQ3) and to refresh system dynamic memory (DACKO). They are active low.

AEN, Address Enable:

This line is used to degate the processor and other devices from the I/O channel to allow DMA transfers to take place. When this line is active (high), the DMA controller has control the address bus, data bus, read command lines (memory and I/O), and the write command lines (memory and I/O).

T/C, Terminal Count:

This line provides a pulse when the terminal count for any DMA channel is reached. This signal is active high.

CARD SLCTD, Card Selected:

This line is activated by cards in expansion slot J8. It signals, "THE SYSTEM BOARD", that the card has been selected and that appropriate drivers on the system board should be directed to either read from, or write to, expansion slot J8. Connectors J1 through J8 are tied together at this pin, but the system board should be driven by an open collector device.

The following voltages are available on the system board I/O channel:

+5 Vdc + — 5%, located on 2 connector pins
—5 Vdc + —10%, located on 1 connector pin
+ 12 Vdc + — 5%, located on 1 connector pin
— 12 Vdc + —10%, located on 1 connector pin
GND (Ground), located on 3 connector pins

1-4 Speaker Interface

The sound system has a small, permanent-magnet, 2¼ inch speaker. The speaker can be driven from one or two sources:

* An 8255A-5 PPI output bit. The address and bit are defined in the "I/O Address Map"

* A timer clock channel, the output of which is programmable within the founctions of the 8253-5 timer when using a 1.19-MHz clock input. The timer gate also is controlled by an 8255A-5 PPI output-port bit. Address and bit assignment are in the "I/O Address Map".

The speaker connection is a 4-pin berg connector, See "System Board Component Diagram", earlier in this section, for speaker connection or placement.

CHAPTER 2
THE NORMAL/TURBO MODE OPERATION

2-1 ADVENTAGES OF THE 10MHZ TURBO

The difference between PIM-TB10 and other PC/XT main boards is the PIM-TB10 main board allows an increase at about 90% in speed of program execution. As the 8088-1 or qualified 8088-2 processor operates at a quicker speed at 10 MHZ. In other PC/XT main board, the clock speed is only 4.77 MHZ. Of course, it is faster than 8MHZ Turbo, too.

The PIM-TB10 consists of dual clock system, in Normal mode, the clock speed is only 4.77MHZ cycle. In Turbo mode, the clock speed increases to 10 MHZ cycle.

Note No. 1: Please do not make use of RAM memory on interface card. Because its original design may be not compatible with 10 MHZ high speed CPU at access time. *Please use memory on mainboard and use 4164 and 41256 & 4464 access time within 150 ns.

For Example:

	4164	41256	4464
NEC	D4164C	D41256C	D4464C
HITACHI	HM4846	HM50256	HM50464
MITSUBISHI	MSK4164	MSM4256P	MH6404AND1
PANASONIC	MN4164	MN41256	MN4464

Note No. 2: Use NEC 70108-10 to enable speed up to 340% faster than normal XT

2-2 To Obtain Turbo Mode at 10 MHZ

The system board suports both software switch as well as hardware switch to allow transaction from Normal mode (4.77 MHZ) to Turbo mode (10 MHZ) and software switch, hardware switch can be used at the same time to select each of them by jumper is not necessary.

A) Software Switch:

Software switch is available when using "ERSO/DTK TURBO" BIOS only.

1) Turn on Turbo Mode:

   Press and hold down the "CTRL" (CONTROL) and "ALT" (ALTERNATIVE) Keys and then press the "—" (MINUS) key then the cursor on screen display will appres as a'BOX' Now, you are ready to use Turbo mode and the Turbo LED is on.

2) Press and hold down "CTRL" (CONTROL) and "ALT" (ALTERNATE) keys and then press the "—" (MINUS) key to come back to Normal mode at 4.77 MHZ. You will see on screen display that the cursor shows up as a "—" (DASH) and the Turbo LED is off.

* ERSO/DTK BIOS is registered copyright under ERSO.
* ERSO: short form from "Electronics Research & Service Organization"

B) Hardware Switch:

1) Jumper Setting

a) Turn on Turbo Mode

Push the Turbo switch into "ON" position to turn on Turbo mode at 10 MHZ and the Turbo LED is on to indicate system being in Turbo Mode now.

b) Return to Normal Mode:

Push the Turbo switch into "OFF" position to come back to Normal mode at 4.77 MHZ and the Turbo LED is off.

Note : 1. The Push button leads to JP6 on main-board. When the botton is pushed in, JP6 i shorted.

2. If you use software switch and hardware switch at the same time, which means you use these two change methods exchange-able, the cursor on the screen display does not indicate the exact execution mode any more.

Because cursor does not change by hard-ware switch, you mix these two changes methods, then the cursor is confused. At this time, the Turbo LED is the only way that you can distinguish normal and Turbo mode.

3. 10MHZ Turbo board can run Lotus 1-2-3, CP/M 86, DBASE III and many other famous IBM package programs. Please use Normal mode (4.77 MHZ) when running Copy Write.

CHAPTER 3
CONNECTORS AND SWITCH SETTING

3-1 Connectors

The system board has the following connectors:

Two power-supply connectos (P1 and P2)

- Speaker connector (JP1)
- Keyboard connector (JP2)
- Keylock connector (JP3)
- Reset connector (JP4)
- Power LED and Turbo LED connector (JP5)

A) Power Supply Connectors (P1 and P2)

Pin	Assignments	Connector
1	Power good	P1
2	Not used	
3	+ 12 Vdc	
4	– 12 Vdc	
5	Ground	
6	Ground	
1	Ground	P2
2	Ground	
3	– 5 Vdc	
4	+ 5 Vdc	
5	+ 5 Vdc	
6	+ 5 Vdc	

B) Speaker Connector (JP1)

The speaker connector is a 2-pin, keyed, 90 degree. The pin assignments as following:

Pin	Function
1	Data out
2	+ 5 Vec

C) Keyboard Connector (JP2)

The keyboard connector is a 5-pin, 90-degree Printed Circuit Board (PCB) mounting, DIN connector. The pin assignments as following:

Pin	Assignments
1	Keyboard clock
2	Keyboard data
3	Keyboard reset
4	Ground
5	+ 5 Vdc

D) Keylock Connector (JP3)

The keylock connector is a 2-pin, keyed, berg strip. When this connector (JP3) is open, keyboard is locked. When this connector (JP3) is shortted, keyboard is unlocked.

E) Reset Connector (JP4)

The reset connector is a 2-pin, keyed, berg strip. When this connector (JP4) is open, system is in regular operation. When this connector (JP4) is shortted for a while, system restarts.

F) Power LED and Turbo LED Connector (JP5)

The power LED and LED connector is a 4-pin Berg strip Its pin assignments as following:

Pin	Assignments
1	Turbo LED (1)
2	Turbo LED (2)
3	Power LED
4	Ground

pin 1 & pin 2 to turbo LED pin 3 & pin 4 to power LED.

3-2 THE SYSTEM BOARD SWITCH SETTING

The DIP Switch (SW1) is used to set the system configuration and specify the amount of memory installed on the system board. Generally the memory switch is useless now.

Position	Function
1	Normal operation off
2	Use for 8087-2 co-processor
3-4	Amount of memory on system board
5-6	Type of display adapter
7-8	Number of 5¼ inch diskette drives

Switch (SW1):

1 = OFF (NORMAL OPERATION)
2 = ON W/O 8087-2 co-processor
3 = OFF W/ 8087-2 co-processor

Memory Switch Settings:

3 = OFF	4 = ON	128K MEMORY INSTALLED
3 = ON	4 = OFF	192K MEMORY INSTALLED
3 = OFF	4 = OFF	256K MEMORY INSTALLED

Display Adapter Switch Settings:

5 = ON	6 = ON	NO DISPLAY ADAPTER
5 = OFF	6 = ON	COLOR/GRAPHICS (40x20 Mode)
5 = ON	6 = OFF	COLOR/GRAPHICS (80x25 Mode)
5 = OFF	6 = OFF	MONOCHROME DISPLAY ADAPTER OR BOTH

Display Dirve Switch Setting:

7 = ON	8 = ON	1 DRIVE INSTALLED
7 = OFF	8 = ON	2 DRIVES INSTALLED
7 = ON	8 = OFF	3 DRIVES INSTALLED
7 = OFF	8 = OFF	4 DRIVES INSTALLED

4-2 ROM CHIPS INSTALLATION

The 10MHZ Turbo Mainboard provides 2 ROM chips space for system.

U38 must be installed 2764 for ROM BIOS.

U49 must be installed 27256 for ROM BASIC.

CHAPTER 4
MEMORY RAM/ROM CHIPS INSTALLATION

4-1 RAM Chips Installation

The 10MHZ Turbo mianboard provides 4 banks of memory

BANK 0 is made up of 9 pieces of 41256 in U90 through U57.

BANK 1 is made up of 9 pieces of 41256 in U89 through U56.

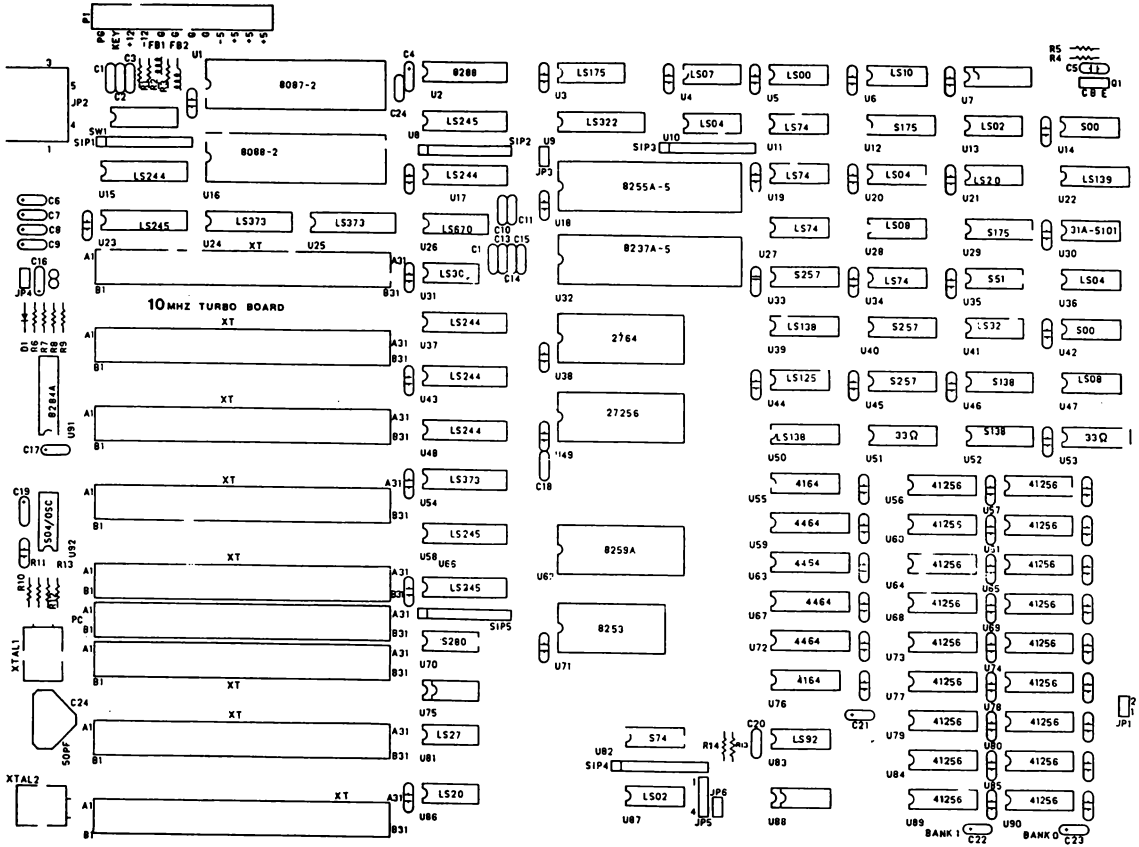
BANK 2 is made up of 2 pieces of 4464 in U63, U59 & 1 piece of 4164 in U55.

BANK 3 is made up of 2 pieces of 4464 in U72, U67 & 1 piece of 4164 in U76.

* 4164 in BANK 2 and BANK 3 is used for parity checking.

4 potions of memory configuration can be installed on board. Follow the instructions below for proper installation:

Option	RAM chips on Bank ϕ	RAM chips on Bank 1	RAM chips on Bank 2	RAM chips on Bank 3
256K RAM	41256 x9	No chip	No chip	No chip
512k RAM	41256x9	41256x9 No chip	No chip	No chip
576K RAM	41256x9	41256x9	4464x2 +4164x1	No chip
640K RAM	41256x9	41256x9	4464x2 +4164x1	4464x2 +4164x1


10MHZ TURBO BOARD
8088-2
8087-2
8284A
8237A-5
8255A-5
8259A
8253
2764
27256
8288
LS244
LS245
LS373
LS670
LS138
LS32
LS125
LS257
LS175
LS74
LS00
LS10
LS02
LS04
LS08
LS20
LS139
LS51
LS92
S74
S280
S27
S00
S04/OSC
4164
41256
33Ω
XT
PC
XTAL1
XTAL2
50PF
BANK 1
BANK 0